Syllabus

(With effect from 2015-2016 Academic year)

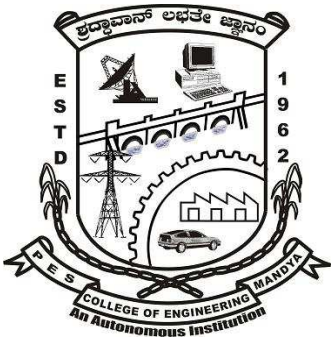
ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2015–16)

III & IV Semester

Bachelor Degree
in
ELECTRONICS AND COMMUNICATION ENGINEERING

Out Come Based Education
with
Choice Based Credit System



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)
Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

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.

Sri.B.Dinesh Prabhu
Deputy Dean (Academic)
Associate Professor,
Dept. of Automobile Engg

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

PES COLLEGE OF ENGINEERING, MANDYA
(An Autonomous Institution, Under VTU)

Vision

"An institution of high repute, imparting quality education to develop innovative and Humane engineers"

Mission

"Committed to develop students potential through high quality teaching- learning processes and state of the art infrastructure"

Department of Electronics and Communication Engineering

About the Department

In the department, the B.E degree was started in 1972 and the M.Tech degree in 2006, the Ph.D and M.Sc (by research) programmes in 2004. Currently the strength of teaching faculty is 20 and that of non teaching staff is 14. The present intake of B.E course is 120 and that of M.Tech course is 49. The teacher - student ratio is 1:16. The department has a research centre under VTU, with 4 research guides and 17 research students. During the last five years, the department has published 15 technical papers in international journals and 10 technical papers in national journals. So far, the department has organized one international and one national conference.

Vision

Developing high quality engineers with sound technical knowledge, skills and ethics in order to meet the global technological and societal demands in the area of Electronics and Communication engineering.

Mission

- Developing high quality graduates and post-graduates of Electronics and communication Engineering with modern technical knowledge, professional skills and attitudes in order to meet industry and society demands.
- Developing graduates with an ability to work productively in a team with professional ethics and social responsibility.
- Developing highly employable graduates and post graduates who can meet industrial requirements and bring innovations.
- Moulding the students with foundation knowledge and skills to enable them to take up post-graduate programmes and research programmes at the premier institutes.
- Providing students with an excellent academic ambience to instil leadership qualities, character moulding and life-long learning necessary for a successful professional career.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(A) Programme Educational Objectives (PEOs)

The Bachelor of Engineering Programme in Electronics and Communication Engineering [B.E. (E&C)] during four years term aims to

I. Provide the students with strong fundamental and advanced knowledge in mathematics, science and engineering with respect to Electronics and Communication Engineering discipline with an emphasis to solve engineering problems

II. Prepare the students through well - designed curriculum to excel in bachelor degree programme in E&C Engg. in order to engage in teaching or industrial or any technical profession and to pursue higher studies

III. Train students with intensive and extensive engineering knowledge and skill so as to understand, analyze, design and create novel products and solutions in the field of electronics and communication engineering.

IV. Inculcate in students the professional and ethical attitude, effective communication skills, team spirit, multidisciplinary approach and ability to relate engineering issues to broader social context.

V. Provide students with an excellent academic environment to promote leadership qualities, character moulding and lifelong learning as required for a successful professional career.

(B) Programme Outcomes (POs):

The BACHELOR OF ENGINEERING Programme in Electronics and Communication Engineering [B.E. (E&C)] must demonstrate that its graduates have

a) An ability to apply knowledge of mathematics, science and engineering to develop both analog and digital electronic and communication circuits and systems including software and hardware entities.
b) An ability to design and construct analog and digital electronic circuits, and to conduct experiments on them to analyze and interpret data.
c) An ability to design simulate and fabricate electronic and communication systems, Components, devices as well as to design and simulate the analog and digital processes of physical world.
d) An ability to function effectively as an individual and as a member of engineering teams of electrical, computer, information, automobile, mechanical and other disciplines.
e) An ability to identify, formulate and solve the problems of both analog and digital electronic and communication circuits and systems including software and hardware entities.
f) An understanding of professional and ethical responsibility at local, national and international levels.
g) An ability to effectively communicate orally and in writing on social and technical occasions in local and global scenarios.
h) The broad education to understand the impact of engineering solutions in a global and societal context.
i) An ability to engage in independent and lifelong learning in the broad context of technological change.
j) A knowledge of contemporary issues at local , national and international levels.
k) An ability to use the techniques, skills and modern engineering hardware and software tools which are necessary for engineering practice.

These programme outcomes (POs) are achieved through an array of courses. To ensure the achievement of POs, the course learning outcomes (CLOs) are so formulated that they address the POs.

PES COLLEGE OF ENGINEERING, MANDYA

(An Autonomous Institution, Under VTU)

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

Sl. No.	Course Code	Course Title	Teaching Dept.	Hours/Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P15MAT31	Engineering Mathematics-III (CC-1)	Maths	3:2:0:5	4	50	50	100
2.	P15EC32	Analog Electronic Circuits (CC-2)	ECE	4:0:0:4	4	50	50	100
3.	P15EC33	Digital Electronics Circuits (CC-3)	ECE	4:0:0:4	4	50	50	100
4.	P15EC34	Electronic Instrumentation (CC-4)	ECE	4:0:0:4	4	50	50	100
5.	P15EC35	Network Analysis & Synthyesis (CC-5)	ECE	4:0:0:4	4	50	50	100
6.	P15EC36	Signals and Systems (CC-6)	ECE	2:2:0:4	3	50	50	100
7.	P15ECL37	FET and Opamp Circuits laboratory	ECE	0:1:2:3	1.5	50	50	100
8.	P15ECL38	Digital circuits design laboratory	ECE	0:1:2:3	1.5	50	50	100
9	P15HU**DIP**39	Comprehensive Communication Development(CCD)	HS & M	2:0:0:2	[2]	[50]	[50]	[100]
10	P15HU39	**Aptitude and Reasoning Development - BEGINNER (ARDB)	HS&M	2:0:0:2	0	(50)	--	--
12	P15MA**DIP**31	*Additional Maths-I	Maths	4:0:0:4	0	--	---	---
13	P15HM**DIP**310	* Indian Constitution, Human Rights & Professional Ethics	Human& Science	2:0:0:2	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.	Hours/ Week L:T:P:H	Total Credit	Examination Marks		
						CIE	SEE	Total
1.	P15MAES41^{++}	Engineering Mathematics-IV (CC-1)	Maths	3:2:0:5	4	50	50	100
2.	P15EC42	Analog Communication(CC-2)	ECE	4:0:0:4	4	50	50	100
3.	P15EC43	Power Electronics(CC-3)	ECE	4:0:0:4	4	50	50	100
4.	P15EC44	Digital Signal Processing(CC-4)	ECE	4:0:0:4	4	50	50	100
5.	P15EC45	Microcontroller(CC-5)	ECE	4:0:0:4	4	50	50	100
6.	P15EC46	Electromagnetic Field Theory(CC-6)	ECE	4:0:0:4	3	50	50	100
7.	P15ECL47	Power Electronics laboratory	ECE	0:1:2:3	1.5	50	50	100
8.	P15ECL48	Microcontroller Laboratory	ECE	0:1:2:3	1.5	50	50	100
9	P15HU49	Aptitude and Reasoning Development – Intermediate (ARDI)	HS&M	2:0:0:2	1	50	50	100
10	P15MA**DIP**41	*Additional Maths-II	Maths	4:0:0:4	0	--	--	--
11	P15EV**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

Evaluation Scheme							
Scheme	**Weightage**	**Marks**	**Event Break Up**				
CIE	50%	50	**Test I**	**Test II**	**Quiz I**	**Quiz II**	**Assignment**
			35	35	05	05	10
SEE	50%	50	**Questions to Set: 10**		**Questions to Answer: 5**		

Semester:- III

Course Title: Engineering Mathematics-III			
Course Code: P15MA31	**Semester:** III	**L – T – P – H :** 3– 2 – 0 – 5	**Credits:** 04
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 P15MA31 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.
Central differences: Gauss Forward and Backward difference formulae, Stirling's, and Bessel's formulae (All formulae without proof) – Illustrative problems. **10 Hrs**

UNIT-II

Numerical differentiation using Newton's forward and backward interpolation formulae, Newton's divided difference formula and Stirling'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. **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. **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 – problems. Convolution theorem, Parseval's identities for Fourier transforms (statements only).

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

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. **11 Hrs**

Text Books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, New Delhi,42^{nd} 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. Peter V O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole ,5th edition,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. 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.

Engineering Mathematics-III(P15MA31)

Time - 3Hrs **Max. Marks- 100**

Note: Answer any FIVE full questions choosing at least one full question from each unit

Model Question Paper	Marks	CO's	Levels
UNIT- I			
1. a) Find the missing values in the following data:	6	1	L1
b) The table gives the distances in nautical miles of the visible horizon for the given heights (in feet) above the earth's surface:	7	1	L2
Find the values of y when $x = 410\ ft$.			
c) Given $u_{20} = 24.37, u_{22} = 49.28, u_{29} = 162.86$ and $u_{32} = 240.5$, find u_{28} by Newton`s divided difference formula.	7	1	L2
2. a) Use Lagrange interpolation to fit a polynomial to the following data.	6	1	L2
Hence find f (1.5) and f(5).			
b) Using Gauss backward difference formula, find y(8) from the following table:	7	1	L2
c) Using sterlings formula find y_{35} given $y_{20} = 512,\ y_{30} = 439,\ y_{40} = 346,\ y_{50} = 243$	7	1	L3

x	0	1	2	3	4	5	6
y	5	11	22	4	__	140	__

x = height	100	150	200	250	300	350	400
y = distance	10.63	13.03	15.04	16.81	18.42	19.9	21.27

x	0	1	3	4
y	-12	0	6	12

X:	0	5	10	15	20	25
Y:	7	11	14	18	24	32

UNIT- II

3 a).Given the data				
Compute $y''(2)$ and $y''(4)$				
b) Find the $f''(6)$ from the following data				
X: 0 2 3 4 7 8				
Y: 4 26 58 112 466 922				
using Newton's divided difference formula				
c) The table below reveals the velocity v of a body during the specific time t , Find the acceleration at t=1.1				
t: 1.0 1.1 1.2 1.3 1.4				
v: 43.1 47.7 52.1 56.4 60.8				
4 a) Find the approximate value of $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by Simpson's $1/3^{rd}$ rule by dividing $[0,\ \pi/2]$ into 6 equal parts.				
b) Use Boole's formula to compute $\int_0^{\pi/2} e^{\sin x}\, dx$				
c) Evaluate $\int_0^1 \frac{x\,dx}{1+x^2}$ by Weddle's rule taking seven ordinates and hence find $\log_e 2$.				

x	– 2	– 1	0	1	2	3
y	0	0	6	24	60	120

	6	2	L3
	7	2	L3
	7	2	L3
	6	2	L2
	7	2	L2
	7	2	L2

UNIT- III

5. (a) If f(x)= x(2π – x) in 0≤ x ≤ 2π, obtain the Fourier series of f(x)	6	3	L2
(b) Find a Fourier series in $[-\pi,\pi]$ to represent $f(x) = x - x^2$. Hence deduce that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\cdots\cdots=\frac{\pi^2}{12}$.	7	3	L2
(c) Draw the graph of the function $f(x)=\begin{cases}\pi x, & 0\le x\le 1\\ \pi(2-x), & 1\le x\le 2\end{cases}$ and Express f(x) as a Fourier series	7	3	L3
6 (a) Obtain the complex Fourier series of $f(x)=\begin{cases}0, & 0<x<l\\ a, & l<x<2l\end{cases}$ over $[0,\ 2l]$.	6	3	L2
(b) Find the cosine half range series for $f(x) = x(l-x);\ 0\le x\le l$	7	3	L3
(c) Express y as a Fourier series up to the third harmonic given the following data:	7	3	L3

x	0	π/3	2π/3	π	4π/3	5π/3	2π
y	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

UNIT- IV			
7. (a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, \lvert x \rvert < \alpha \\ 0, \lvert x \rvert \geq \alpha \end{cases}$ and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$	6	4	L2
(b) Find the Fourier sine transform of $f(x) = e^{-\lvert x \rvert}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx, m > 0$.	7	4	L2
(c) Solve the integral equation $\int_0^\infty f(x)\cos \alpha x dx = e^{-a\alpha}$.	7	4	L3
8. (a) Obtain the Z-transform of $\cos n\theta$ and $\sin n\theta$.	6	4	L1
(b) Compute the inverse Z-transform of $\frac{3z^2+2z}{(5z-1)\ (5z+2)}$	7	4	L2
(c) Solve by using Z-transforms: $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$.	7	4	L3

UNIT- V			
9 (a). Form the partial differential equations by elimination of arbitrary function in $f(x^2+2yz, y^2+2xz\ ) = 0$.	6	5	L1
(b). Solve by the method of separation of variables $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$ given that $u(0, y) = 2e^{5y}$.	7	5	L3
(c). Solve: $(mz-ny)p + (nx-lz)q = (ly-mx)$.	7	4	L2
10 (a) Find the various possible solutions of the one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables	10	5	L3
(b) Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(0,t) = 0,\ u(l,t) = 0$ for $t \geq 0$ and $u(x,0) = 0$, $\frac{\partial u}{\partial t}(x,0) = x(l-x),\ 0 \leq x \leq l$.	10	5	L3

Course Title: Analog Electronics Circuits			
Course Code: P15EC32	**Semester: 3rd**	**L – T – P : 4 – 0 - 0**	**Credits: 4**
Contact Period - Lecture: 52 Hrs.; Exam:3 Hrs.		**Weightage: CIE: 50%;**	**SEE: 100%**

Prerequisites:

1. Electronic devices and communication- P15EC25

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.

Relevance of the Course:

1. Digital CMOS VLSI Design –P15EC52
2. Analog CMOS VLSI Design – P15EC71
3. Low Power VLSI Design – P15EC743

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.

Text1: 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, Instrumentation 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, 3.8, 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 oscillator, Wein bridge oscillator, Active Filters –First and second order Low pass & High pass filters.
DC Voltage Regulators: Voltage Regulator Basics, op–amp series voltage Regulator, Adjustable Output Regulator, Integrated Circuit linear Voltage Regulators: 723, LM317and LM337 IC Regulators.
Text2:10.3, 11.1, 11.3, 12.2, 12.3, 13.1, 13.2, 13.3, 13.5 **11 Hrs**

Self learning components
Study and understanding the usage of circuit Simulation softwares Multisim/E-Sim.
Simulation of MOS transistor circuits, Op-amp circuits and 555 timer based circuits.

TEXT BOOKS:

1. "Microelectronic Circuits Theory and Applications", Adel S. Sedra, Kenneth C. Smith Adapted by Arun N. Chandorkar, 6th Edition International Version, Oxford.
2. "Operational Amplifiers and Linear IC's", David A. Bell, 3rd edition, Oxford university Press, 2011.

REFERENCE BOOKS:

1. "Electronic devices and circuit theory" Robert L. Boylestad and Louis Nashelsky, pearson 10th edition. (for self learning component).
2. "Electronic Devices and Circuit Theory", Robert L. Boylestad and Louis Nashelsky, PHI, 9th Edition.
3. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 2nd edition, Reprint 2006, New Age International.
4. "Op – Amps and Linear Integrated Circuits", Ramakant A. Gayakwad, 4th edition, PHI.

Course Outcomes

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

01 Describe the working of MOSFETs and its biasing circuits. – L2 (Unit – I)
02 Explain the single–stage MOS amplifier and its frequency response. – L2 (Unit – I)
03 Analyze the working of instrumentation amplifier and AC amplifier – L4 (Unit – II)
04 Differentiate the operations of voltage sources, current sources and current amplifiers.– L4 (Unit – III)
05 Relate the different waveforms generated using precision rectifiers, limiting circuits, and sample & hold circuits, differentiating and integrating circuits, Astable and Monostable Multivibrator using 555 timer – L3 (Unit – IV)
06 Compare the operations of voltage follower regulator, adjustable output regulator, precision voltage regulator and IC voltage regulator. – L4 (Unit – V)

MODEL QUESTION PAPER

Q. NO	Model Question Paper	MARKS	CO'S	LEVELS
	Unit-1			
1(a)	Compare MOSFET with BJT	06	1	L4
(b)	Write the physical structure of NMOS transistor. Explain	08	1	L2
(c)	An NMOS device has μnCox=100μA/V2, W=10μm, L=1μm, Vt=0.7V, VGS=1.5V dc. Find the value of drain current for VDS=0.5 V	06	1	L3
	OR			
2 (a)	Explain operation of MOSFET as an amplifier and as a switch.	06	1	L2
(b)	What is biasing? Explain basing using constant current source in MOS transistor	08	1	L1
(c)	A MOSFET is to operate at ID=0.1mA and is to have gm=1mA/V. If Kn=50μA/V2, find the required W/L ratio and the overdrive voltage.	06	1	L3
	Unit-2			
3(a)	Draw a basic op-amp internal circuit diagram. Explain	10	2	L3
(b)	Define the following parameters (a) Slew rate (b) CMRR (c) PSSR	6	2	L1
(c)	An op-amp circuit is to have a 10 KHZ triangular output waveform with a 12V peak to peak amplitude. Calculate the op-amp minimum slew rate.	4	2	L4
	OR			
4(a)	Compare voltage follower with emitter follower	06	2	L4
(b)	Design an inverting amplifier using 741 op-amp. The voltage gain if to be 50 and the output voltage amplitude is to be 2.5v.	06	2	L5
(c)	Explain capacitor coupled voltage follower.	08	2	L2
	Unit-3			
5(a)	Sketch the circuit of a capacitor-coupled inverting amplifier. Briefly explain the circuit operation, and	10	3	L3
(b)	define its input impedance.	10		
	Explain different frequency compensation methods		3	L2
	OR	04		
6(a)	Using the gain bandwidth product, estimate the upper cutoff frequency for a non-inverting amplifier with A_{OL}=40dB and gain bandwidth product is 800KHz.	08	3	L3 L2
(b)	Explain Differentiating Circuit and Integrating Circuit	08	3	
(c)	Draw the circuit of a current source for a floating load using op-amp and a BJT. Explain the operation of the circuit.		3	L3
	Unit-4			
7(a)	Sketch the circuit of an op-amp employed as a non inverting zero crossing detector. Sketch typical input and output waveform and explain the circuit wave form.	10	4	L3
	Design a non saturating precision half-wave rectifier to			

(b)	produce a 2V peak output from a 1MHz sine wave input with a 0.5V peak value. Use a bipolar op-amp with a	06	4	L5
(c)	supply voltage of ±15V What is limiting circuits? Give examples	04	4	L1
8(a)	**OR**	10	4	L3
(b)	With circuit diagram and waveform explain the working of precision clamping circuit. Draw the diagram for an op-amp sample and hold circuit. Sketch the signal, control and output voltage waveforms. Explain the circuit operation.	10	4	L3
	Unit-5			
9(a)	Design a triangular waveform generator to produce a ±2V, 1KHz output. Use a ±15V supply	08	5	L5
(b)	State the Barhausen criteria for a sine wave oscillator	04	5	L1
(c)	Sketch and explain the operation of wein bridge oscillator	08	5	L3
	OR			
10(a)	Sketch the circuit of a first-order low-pass active filter and explain how the circuit operates	08	5	L3
(b)	Show how the output voltage of an op-amp series regulator may be made adjustable. Explain.	08 04	5 5	L3 L3
(c)	Sketch LM317 positive voltage regulator.			

Course Title: DIGITAL ELECTRONIC CIRCUITS			
Course Code: P15EC33	**Semester: III**	**L – T – P : 4– 0 - 0**	**Credits:4**
Contact Period -Lecture: 52Hrs.;Exam: 3Hrs.	**Weightage: CIE: 50 %;**		**SEE:50%**

Prerequisites:

1. Fundamental course of Electronic Devices and Communication-P15EC15

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 the architecture of 8086 Microprocessor.

Relevance of the Course:

1. Advanced Microcontrollers- P15EC45
2. Digital CMOS VLSI design- P15EC52
3. Digital Design using Verilog HDL- P15EC61
4. Low Power VLSI Design- P15EC743

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 – McCluskeyMethod 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.

Introduction to Microcomputer and 8086 Architecture: Overview of Microcomputer Systems, General operation of a computer, Microprocessors in Digital System Design, CPU Architecture, Internal Operation.

Text 2: 1.1, 1.4-1.5, 2.1-2.2. **10Hrs**

TEXT BOOKS:

1. Donald D Givone , “Digital Principles and Design”, Tata McGraw Hill, 2002.
2. Yu-Cheng Liu, Glenn A. Gibson, “Microcomputer Systems: The 8086/8088 Family”, 2nd Edition, PHI.

REFERENCE BOOKS:

1. Charles H Roth Jr, “Fundamentals of logic design”, Thomson Learning, 2004.
2. Mano and Kim, “Logic and computer design Fundamentals”, Pearson, Second edition, 2001.
3. Tomas Lang, Jaime H Moreno, “Introduction to Digital System”, Milos Ercegovac, John Wiley, 2005.
4. Barry B Brey, “Intel Microprocessors - Architecture Programming & Interfacing”, Pearson Education Limited, 2013.

Course Outcomes

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

1. Compare the performance characteristics like speed, power dissipation, noise margin and Propagation delay. – L4 (Unit – I)
2. K–map and VEM technique for Logic Simplification. Design the logic circuit using digital devices for applications like decoders, encoders, PROM, PLD and Multiplexers involving combinational logic. – L5 (Unit – II)
3. Apply the knowledge of Boolean algebra to design digital systems like comparators, code convertors, adder and subtractors. –L3 (Unit – III)

4. Understand the basic blocks like SR, JK, D&T latches, flip–flop and apply the knowledge of flip–flops for designing switch debouncer circuit.-L3 (Unit – IV)
5. Design the shift registers, Asynhronous, Synchronous and Modulo Up/Down counters using Flip-Flops.-L5 (Unit-V)
6. Describe the architecture of 16-bit 8086microprocessor, data representation formats in computer system and significance of Segmentation.-L2 (Unit-V)

Model question paper

Q NO	QUESTIONS	Marks	BTL	CO
1. a)	With a help of a circuit diagram explain operation of i. 2 input CMOS NOR gate. ii. 2 input CMOS NAND gate	7	L2	1
b)	Explain with circuit diagram operation of ECL NOR gate	8	L2	1
c)	Give the comparison between DTL, RTL &TTL logic **OR**	5	L3	1
2. a)	Draw the 2 input TTL NAND gate circuit with totem pole output & explain its working	10	L3	1
b)	Explain operation of n-channel type MOSFET with a neat circuit diagram and V-I Characteristics.	10	L2	1
3. a)	Simplify using k-map f(A,B,C,D) =Π(0,4,5,7,8,9,11,12,13,15)	6	L4	2
b)	A single output variable Z is to be true when the input variables 'a'&'b' are true & when 'b'is false but 'a' & 'c' are true. Write truth table & switching equations	5	L4	2
c)	Using K-map determine all the Prime Implicants and Prime Implicates for the following incomplete Boolean function and indicate which are essential. f(w,x,y,z)= ∑m(0,2,5,7,8,10,13,15)+d(1,4,11,14) OR	9	L4	2
4. a)	Simplify using QMc minimization technique S=f(w,x,y,z)=∑(1,3,13,15)+∑d(8,9,10,11)	10	L4	2
b)	Simplify using VEM technique & realize using basic gates T=f(w,x,y,z)=∑(2,4,5,10,11,14)+∑d(7,8,9,12,13,15)	10	L4	2
5. a)	Design a combinational circuit that multiplies two 2-bit binary numbers	8	L5	3
b)	Design a 4-bit priority encoder	7	L5	3
c)	Realize 4:16 decoder using two 3:8decoder OR	5	L5	3
6. a)	Explain with neat diagram & expressions the working of look ahead carry adder	8	L3	3
b)	Design the following expression using PLA f1(x,y,z) = ∑m(3,6,7) f2(x,y,z)= ∑m(0,1,2,6,7) f3(x,y,z)= ∑m(0,1,3,4,5)	12	L5	3
7. a)	Explain with neat diagram application of SR latch in switch debouncing circuit	6	L2	4
b)	With neat diagram & waveforms explain the working of Master Slave JK Flip-Flop.	8	L2	4
c)	What is a latch? with neat diagram &waveforms explain the working of gated D-latch OR	6	L2	4
8. a)	Explain the working of S' R' latch with neat diagrams & waveforms	6	L3	4
b)	With neat diagram &waveforms explain the working of Master Slave SR Flip-Flop.	7	L2	4

c)	What is edge triggering? Explain the working of positive edge triggered DFF?	7	L2	4
9. a)	Design a synchronous mod-6 counter using clocked JK- flip flop	8	L5	5
b)	With neat diagram explain the working of universal shift register	6	L2	5
c)	Write the characteristic equation & excitation table for SR, JK & D FF OR	6	L3	5
10.a)	With a neat diagram explain the architecture of 8086 micro processor.	12	L1	5
b)	Discuss about the concept of segmentation in 8086	8	L2	5

Course Title: Electronic Instrumentation			
Course Code: P15EC34	**Semester: III**	**L – T – P : 4 - 0 - 0**	**Credits: 4**
Contact Period - Lecture: 52Hrs.; Exam: 3 Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Prerequisites:

1. Electronics Devices and communication – P15EC15

Course Learning Objectives (CLOs):

This Course aims to;

1. Define and explain various errors.
2. Discuss the basic construction of Voltmeters and Multimeters.
3. With a neat 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. Illustrate the operation of a photodiode.
6. Sketch spectrum analyzer displays for various input waveforms.
7. With an illustration, 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.

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 BOOKS:

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

REFERENCE BOOKS:

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

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Course Outcomes

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

1. Explain the different types of measurement errors– gross error, systematic error, instrumental error, Environmental error and Observational error. – L2 (Unit – I)
2. Differentiate between the DC and AC voltmeters. – L4 (Unit – I)
3. Design the bridge circuit for measurement of resistance, inductance and capacitance.– L5 (Unit – II)
4. Compare the different types of electrical transducers with examples. – L4 (Unit –III)
5. Analyze the working of wave analyzer, harmonic distortion analyzer and spectrum analyzer. – L4 (Unit – IV)
6. Discuss the concepts of signal conditioning and data acquisition system. -L2 (Unit – IV)
7. Explain the working of Special Oscilloscopes.-L2(Unit – V)
8. Describe the working of various signal generators. – L2 (Unit – V)

Model Question Paper

Q NO	QUESTIONS	Marks	CO	Levels
1. a)	Define the following errors: gross error, systematic error, instrumental error, environmental error and observational error.	10	1	L1
b)	A voltmeter is accurate to 98% of its full scale reading. (i) If a voltmeter read 200V on 500V range, what is the absolute error? (ii) What is the percentage error reading of part (i)	6	1	L3
c)	List the advantage of Digital meters over Analog meters.	4	1	L1
	OR			
2. a)	State the difference between accuracy and precision of an experiment.	6	1	L2
b)	Calculate the value of multiplier resistor for a 10V RMS ac range on the voltmeter, I_{fsd}=1mA, R_m=250 Ω.	6	1	L3
c)	Classify the Digital Voltmeter (DVM) and explain its operating principle.	8	1	L4
3. a)	A highly sensitive galvanometer can detect a current as low as 0.1μA. This galvanometer is used in the Wheatstone bridge as a detector. The resistance of the galvanometer is negligible. Each arm of the bridge has a resistance of 1 KΩ. The input voltage applied to the bridge is 20V. Calculate approximately the smallest change in resistance which can be detected.	10	2	L5
b)	Explain the ramp type digital voltmeter with the help of a block diagram	10	2	L4
	OR			
4. a)	Draw the Maxwell's bridge circuit and derive the necessary equations to find unknown inductance.	8	2	L5
b)	Explain the importance of Wagner's earth connection.	4	2	L2
c)	Find the equivalent parallel resistance and capacitance that causes a wein bridge to null with the following component values: R1=3.1KΩ, C1=5.2μF, R2=25KΩ, f=2.5kHz and R4=100kΩ	6	2	L3
5. a)	What are the factors to be considered for the selection of better transducer? Explain.	6	3	L1
b)	Explain the basic principle of resistance thermometer and thermistor.	8	3	L2
c)	List the different types of photoelectric transducers.	4	3	L1
	OR			
6. a)	Define the strain gauges and classify different types of strain gauges.	10	3	L3
b)	Explain the construction, principle and operation of Linear Variable Differential Transducer (LVDT).	10	3	L3
7. a)	What is the difference between a wave analyzer and a harmonic distortion analyzer?	6	4	L1
b)	Explain the working of heterodyne wave analyzer.	10	4	L3
c)	State the applications of a spectrum analyzer. OR	4	4	L2
8. a)	Explain the operation of instrumentation amplifier using Op-amp.	6	4	L3
b)	Discuss the signal conditioning of inputs, single channel data acquisition system, multi-channel DAS and computer based DAS	6	4	L4
c)	Describe the operation of Differential Instrumentation amplifier using Transducer Bridge	8	4	L3
9. a)	Sketch, and explain, the complete block diagram and the system waveforms for the sweep frequency generator and frequency synthesizer.	10	5	L4
b)	List the various controls on the front panel of the pulse generator, mention their uses. OR	10	5	L1
10.a)	Explain the block diagram of delayed time base oscilloscope and its need.	10	5	L3
b)	Explain the basic operation of Digital Storage Oscilloscope (DSO) along with the relationship between sampling rate and bandwidth.	10	5	L3

Course Title: Network Analysis and Synthesis			
Course Code: P15EC35	**Semester: 3**	**L – T – P : 4 – 0 - 0**	**Creditsa: 4**
Contact Period- Lecture: 52Hrs.; Exam: 3Hrs.	**Weightage: CIE: 50 %; SEE: 50%**		

Prerequisites:

1. Electronic devices and communication – P15EC15.
2. Engineering Mathematics.-I,II,III-P15EC11/21/31
3. Engineering physics.

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.

Relevance of the Course:

1. Analog Electronics circuits- P15EC32
2. Power Electronics - P15EC43
3. Digital CMOS VLSI Design - P15EC52
4. Analog CMOS VLSI Design - P15EC71

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. William Hayt, Jack Kemmerly, Steven Durbin, *Engineering Circuit Analysis*, 8e, McGraw Hill.
2. Ravish R Singh, *Network Analysis and Synthesis*, McGraw Hill.

REFERENCE BOOKS:

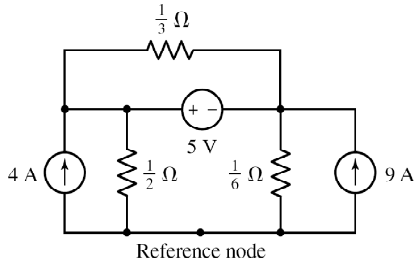
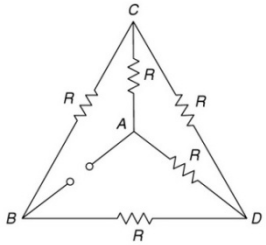
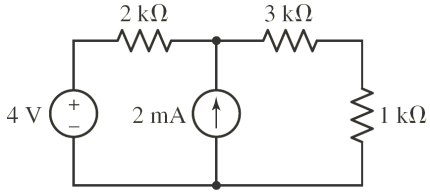
1. Syed Nasar, *3000 Solved Problems in Electric Circuits*, Schaum's Solved Problems, McGraw Hill.
2. William Hayt, Jack Kemmerly, *Problems and Solutions in Engineering Circuit Analysis*, McGraw Hill.
3. Nilsson, Riedel, *Electric Circuits*, 10e, Pearson Education.
4. Irwin, Nelms, *Basic Engineering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

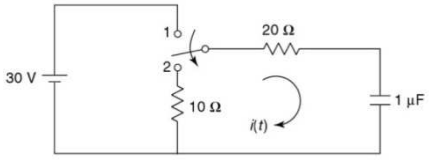
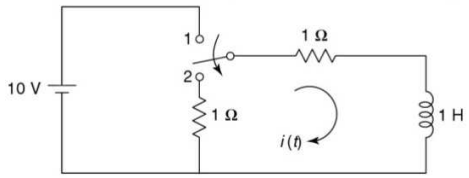
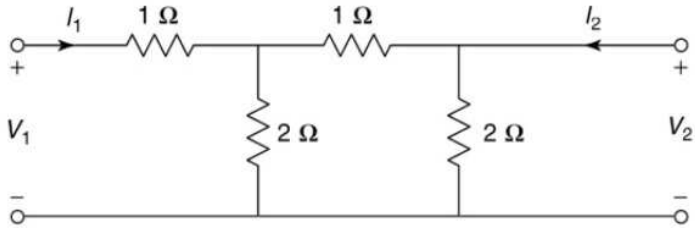
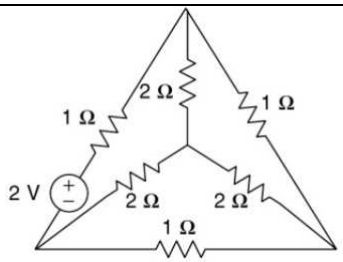
Course Outcomes

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

1. Apply the concept of various network theorems to solve complex electrical circuits. –L3 (UNIT -I)
2. Evaluate a tuned network's quality factor, bandwidth, and power levels at important frequency levels. –L5 (UNIT -II)
3. Make use of the Laplace transform method to study transient behaviour of electric circuits. –L3 (UNIT -III)
4. Obtain a relationship between various two-port networks. –L4 (UNIT -IV)
5. Make use of graph theory concept for solving networks with a large number of nodes and branches. –L3 (UNIT -IV)
6. Formulate various synthesis methods for different one-port networks. –L5 (UNIT -V)

Model question paper

Q No.	QUESTIONS	Marks	CO's	Levels
1. a)	Compare the following with suitable examples. (i) Linear and non-linear elements (ii) Independent and dependent sources	7	1	L2
b)	For the circuit shown in figure 1, evaluate the voltage across each current source.  Fig 1.	8	1	L5
c)	What is the resistance between the terminals A and B in the network of figure 2 when the potential difference between C and D is zero?  Fig 2.	5	1	L2
	OR			
2. a)	State and explain Thevenin's theorem as applied to ac circuits.	7	1	L2
b)	Determine the Norton equivalent circuit for the network faced by the 1 kΩ resistor in figure 3.  Fig 3.	8	1	L5
c)	Analyze the condition for maximum power transfer for an ac circuit.	5	1	L4
3. a)	Compare the properties of series and parallel resonance.	7	2	L2
b)	A series resonance circuit with R = 17Ω, L = 0.1H and C = 50μF has an applied voltage V = $50\angle 0^0$ with a variable frequency. Find the resonant frequency, the value of frequency at which maximum voltage occurs across inductor and the value of frequency at which maximum voltage occurs across capacitor.	8	2	L5
c)	Define (i) quality factor and (i) selectivity.	5	2	L1
	OR			
4. a)	Explain the following mathematically (i) The current through an inductor cannot change instantaneously.	7	2	L5
b)	Determine the transient response of series RC circuit having D.C excitation.	8	2	L5

c)	In the network shown in figure 4, the switch is changed from the position 1 to the position 2 at t=0, steady condition having reached before switching. Find the values of i, di/dt and d^2i/dt^2 at $t=0^+$  Fig 4.	5	2	L3
5. a)	Explain the advantages of analyzing the circuits using frequency domain rather than the time domain. How can the initial conditions of a circuit be incorporated using Laplace transform?	8	3	L2
b)	Develop the Laplace transform of a full wave rectified sine wave of amplitude 1 and period π seconds.	7	3	L3
c)	Evaluate the inverse Laplace transform of $(1)/((s-2)(s+2)^2)$.	5	3	L5
	OR			
6. a)	State and prove (i) initial value theorem and (ii) final value theorem as applied to Laplace transform. What is the limitation of each theorem?	7	3	L5
b)	In the network of figure 5, the switch is moved from the position 1 to 2 at t=0, steady-state condition having been established in the position 1. Determine i(t) for t>0.  Fig 5.	8	3	L5
c)	Explain the application of convolution integral in the analysis of linear systems.	5	3	L2
7. a)	Define Z-parameter, Y-parameter and h-parameter with necessary matrices.	7	4	L1
b)	Evaluate ABCD parameters for the network shown in figure 6.  Fig 6.	8	4	L5
c)	Develop h-parameters in terms of Z-parameters for a two-port network.	5	4	L6
	OR			
8. a)	Define (i) Planar graph (ii) Non planar graph (iii) path (iv) Rank of a graph	8	5	L1
b)	For the network show in figure 7, write down the tieset matrix and obtain the network equilibrium equation in matrix form using KVL. Solve for the loop currents and branch currents.  Fig 7.	7	5	L3
c)	List the steps followed in finding the dual of a network.	5	5	L1
9. a)	Find whether the polynomial $G(s) = s^2+2s^2+3s+6$ is Hurwitz	7	6	L1

b)	Find whether the function $F(s)=(s^2+1)/(s^3+4s)$ is a positive real function.	8	6	L1
c)	Suppose $F_1(s)$ and $F_2(s)$ are both positive real. Discuss the conditions such that $F(s) = F_1(s) – F_2(s)$ is also positive real.	5	6	L6
	OR			
10.a)	Construct a network for the admittance function $Y(s) = (7s+2)/(2s+4)$.	7	6	L3
b)	Construct the first and second Cauer forms of LC networks for the impedance function $Z(s) = (s^4+10s^2+9)/(s^3+4s)$.	8	6	L3
c)	Explain the properties of RL impedance and RC admittance functions.	5	6	L2

Course Title: Signals and Systems			
Course Code: P15EC36	**Semester: III**	**L – T – P : 4 - 0 - 0**	**Credits: 3**
Contact Period - Lecture: 52Hrs; Exam: 3Hrs.	**Weightage: CIE:50%; SEE: 50%**		

Prerequisites:

1. Engineering mathematics – I – P15EC11
2. Engineering mathematics – II –P15EC21
3. Engineering mathematics – III –P15EC31

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.

Relevance of the Course:

1. Digital Signal Processing – P15EC44
2. Digital Image Processing – P15EC72
3. Digital Signal Processor and Applications – P15EC753

Course Content

UNIT – I

Signals and systems

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.

Text: 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).

Text: 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.

Text: 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.

Text: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.

Text: 10.0 to 10.9 11 Hrs

Self Learning Components

- Study of simulation tools Scilab/ Matlab/ octave (anyone of them)
- Simulation of signals, verification of signal & system properties, Frequency representation of various signaltypes, system design, understanding signals and systems in complex-plane and Frequency analysis of signals & Frequency response of systems.

TEXT BOOK:

1. Signals and Systems, V.Oppenheim, Alan Willsky and A.HamidNawab, Pearson education asia/PHI, 2nd edition, 2006.

REFERENCE BOOKS:

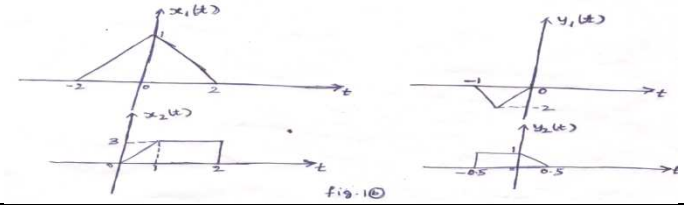
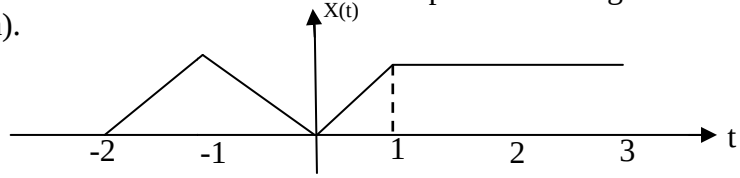
1. Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition John Wiley & Sons, 2nd edition 2008.
2. Signals and systems, H.P.Hsu, R.Ranjan, Schaum's outlines, TMH, 2006.
3. Signals and systems, A NagoorKani, McGraw Hill 2010 .
4. Fundamentals of signals and systems, Michael J Roberts, Govind Sharma, McGraw Hill 2010.

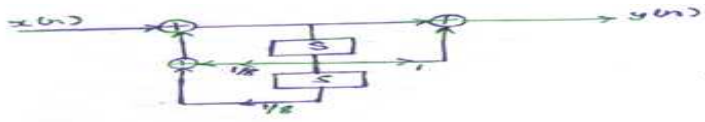
Course Outcomes

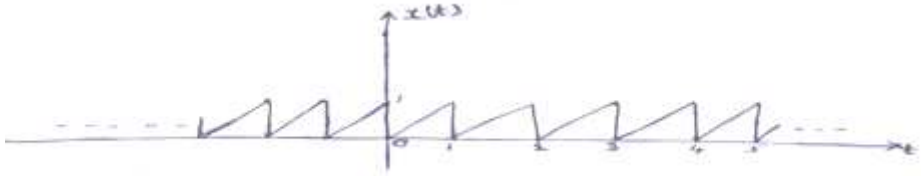
After learning all the units of the course, the student is able to

1. Recognize the naturally existing signals and systems & its mathematical representation with different operation on these signals and systems. – L1, L2 (Unit – I)
2. Characterization of LTI system and mathematical operation of these system with simple implementation schemes. -L2, L3 (Unit – II)
3. Apply Frequency domain representation to Continuous Time signals and discuss their properties. L3 (Unit – III)
4. Explain the Process of discretizing and reconstruction of continuous time signals and phenomena of aliasing. L2 (Unit – IV)
5. Frequency domain representation of Discrete Time signals and properties. L2 (Unit – IV)
6. Z-transform as a tool to perform frequency analysis of a Discrete Time signal. L2 (Unit - V)

Model question paper

Q No	QUESTIONS	Marks	BTL	CO's
1. a)	Define a signal and a system. Explain any two properties of a LTI system.	6	L2	1
b)	Determine the relationship between the signals $x_1(t)$ and $y_1(t)$ and $x_2(t)$ and $y_2(t)$ shown in figure 1(b). 	8	L5	1
c)	Interpret whether the following signals are periodic or not. If periodic, determine their fundamental period. (i) x(n) = $\cos(\frac{\pi n}{7})\sin(\frac{\pi n}{5})$. (ii) x(t) = $[2\cos^2(\frac{\pi t}{2}) - 1]\sin \pi t \cos \pi t$	6	L2	1
	OR			
2. a)	Determine and sketch the Even and Odd parts of the signal shown in fig2(a).  Fig. 2(a)	5	L5	1
b)	Inspect the system below as linear, stable, memoryless, casual and time invariant. i) $y(t) = x(t) + t^2x(t)$ ii)$y(n) = 2x(n) + \frac{1}{x(n-1)}$	10	L4	1
c)	Determine the overall operator of a system whose output signal y(n) is given as $y(n) = \frac{1}{3}\{x(n+1) + x(n) + x(n-1)\}$and also draw the block diagram representation.	5	L2	1
3. a)	Determine the output of an LTI system whose impulse response is (i) h(t) = 3u(t-1) – 3u(t-3) and the input is x(t) = u(t+1) – 2u(t-1) + u(t-3) (ii) h[n] = u[n-1] and the input is x[n] = $\cos[\frac{\pi n}{2}]u[n]$.	10	L5	2
b)	A LTI system has impulse response of h(t) given as h(t)=tu(t)+(10-2t)u(t-5)-(10-t)u(t-10). Determine the response of the system for a step input.	10	L5	2
	OR			
4. a)	Determine the output response of the following system given the input and initial condition as x[n] = 2^n u[n] and y(-1) = 2,Y(-2) = -1.	10	L5	2

	 Fig.4(a)			
b)	Determine whether the system is i)Memory less ii) iii)Stable h(t)=u(t+1)	4	L5	2
c)	Write direct form 1 and direct form II implementations for the difference equation. $y[n]+\frac{1}{2}$y[n-1] - $\frac{1}{8}$y[n-2] = x[n]+ 2x[n-1]	6	L3	2

5. a)	Define and prove the following for DTFS representation of signal i) Modulation ii) convolution of two signals.	8	L1	3
b)	Determine the complex Fourier co-efficient for the periodic waveform x(t) shown in figure 5(b). also draw the magnitude & phase spectra.  Fig.5 (b) OR	12	L5	3
6. a)	A discrete time signal is defined by x(n) = $\sin(\frac{n\pi}{8})$. Write the magnitude and phase of the discrete time fourier transform of x(n-2).	8	L3	3
b)	State and prove parseval's theorem as applied to fourier transform.	6	L1	3
c)	Discover the relation between DTFT and Z transform.	6	L4	3
7. a)	Determine the DTFT of the following signals i) x(n)=u(n) ii) x(n)=$(-1)^n$u(n) iii) x(n)=u(n)-u(n-6)	9	L5	5
b)	Determine the signal. Whose DTFT is given by $x(e^{j\Omega})$ =0 ; $0\leq\|\Omega\|\leq\Omega_0$ =1 ; $\Omega_0\leq\|\Omega\|\leq\pi$	6	L3	5
c)	Using appropriate property. Determine the DTFT of the signal x(n)=$\left(\frac{1}{2}\right)^n u(n-2)$. OR	5	L3	5
8. a)	State and explain sampling theorem.	5	L2	4
b)	Explain the basic discrete time signal processing system.	7	L2	4
c)	Identify the Nyquist rate and Nyquist intervals for the following signals: (i) $g_1(t)=\sin c(200t)$ (ii) $g_2(t)=\sin c^2(200t)$ (iii) $g_3(t)=\sin c(200t)+\sin c^2(200t)$.	8	L2	4
9. a)	Explain the following properties of Z- transform mentioning ROC. (i) Time shifting property. (ii) Differentiation in Z – domain.	6	L2	6

b)	Determine the Z – transform of the signal, x(n) = $n\sin(\frac{n\pi}{2})\,u(-n)$.	6	L3	6
c)	Determine inverse Z- transform of the following sequence. (i) X(Z) = $\frac{1}{1-Z^{-2}}$; $\lvert Z\rvert > 1$ (ii) X(Z) = cos(2Z) ; $\lvert Z\rvert < \infty$ OR	8	L3	6
10.a)	The output of a discrete time LTI system is $y(n) = 2(\frac{1}{3})^n u(n)$, when the input x(n) is u(n). (i) Determine the impulse response h(n) of the system. (ii) Determine the output when the input is $(\frac{1}{2})^n u(n)$.	12	L3	6
b)	Solve the following linear constant co-efficient difference equation using Z – transform method. $y(n)-\frac{3}{2}y(n-1)+\frac{1}{2}y(n-2) = (\frac{1}{4})^n u(n)$ with initial conditions y(-1) = 4 and y(-2) = 10.	8	L3	6

Course Title: FET and Op-Amp Circuits Lab			
Course Code: P15EC37	**Semester: 3**	**L – T – P : 0 – 0 - 3**	**Credits: 1.5**
Contact Period - Lecture: 12 Hrs.; Exam:3 Hrs.	**Weightage: CIE: 50%;**	**SEE: 50%**	

Course Learning Objectives

This course aims to

1. Provides the basic knowledge of how to use CRO, signal generator, bread board, power supply, ammeter, voltmeterand how to rig-up the circuits.
2. Obtain the characteristics curves of JFET and MOSFET.
3. Experiment MOSFETamplifier and oscillator.
4. Determine characteristic parameter of Op-Amp
5. Design Inverting and Non-inverting amplifiers, Summing, Subtracting and Schmitt triggercircuit using Op-Amp.
6. Demonstrate the working ofIntegrator, Differentiator circuit, precision half wave and full wave rectifier using 741 IC
7. Experiment the workingDAC using Op-Amp and Voltage regulator using LM 217 IC regulator.

Course Curriculum (Syllabus)

1. JFET and MOSFETinput and output characteristics
2. Wiring of RC coupled single stage MOSFET amplifier and determination of the gain-frequency response, input and output impedances.
3. Writing and testing theMOSFET RC phase shift oscillator for a given frequency.
4. Writing and testing the 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.

Course Outcomes (CO's)

After conducting all the experiments, the student is able to

1. Sketch the input and output characteristics of JFET and MOSFET. - L3
2. Construct the MOSFET amplifier and oscillators – L5
3. Verify the characteristic parameter of Op-Amp – L3
4. Design the Inverting, Non-inverting amplifier, Summer, subtractor and Schmitt trigger using 741 IC-L5
5. Experiment the working of integrator, Differentiator, Precision half wave and full wave rectifierusing Op-Amp– L4
6. Demonstrate the working ofOp-Amp R-2R DAC and voltage regulator using LM217 IC–L3

C) Evaluation scheme

CIE	SEE	Total
50	50	100

CEE

Lab Record	Participation and learning	Test I	Test II
30%	20%	20%	30%

SEE

Write up and procedure	Viva- Voice	Conduction and demonstration of results
15%	15%	70%

Course Title: Digital Circuits Design Lab			
Course Code: P15ECL38	**Semester: III**	**L – T – P : 0 - 0 – 3**	**Credits:1.5**
Contact Period - Lab: 36 Hrs.; Exam: 3 Hrs.	**Weightage: CIE: 50 %;**		**SEE: 50%**

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.

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Course Curriculum (Syllabus)

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.

Course Outcomes

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

1. Construct Optimized Boolean/Combinational Logic circuits based on gates.- L3
2. Design and Implement Half Adder/Subtractors, Full Adder/Subtractors and Parallel Adder/Subtractor. –L6
3. Design and Implement gates and basic combinational expressions using MUX.- L6
4. Design and Implement Gary, BCD and Excess-3 Converters using DEMUX. –L6
5. Design and Implement 2-bit comparator.- L6
6. Test JK, D and T flip-flops and verify their truth tables. –L4
7. Design and Realize Binary, Decimal, Mod UP/DOWN counters and Shift Register-L6

8. Design and Implement Ring counter and Johnson counters. –L6
9. Understand the operation and design of a Simple digital application for eg: elevator. –L2

c) Evaluation scheme

CIE	SEE	Total
50	50	100

CIE

Lab Record	Participation and learning	Test I	Test II
30%	20%	20%	30%

SEE

Write up and procedure	Viva- Voice	Conduction and demonstration of results
15%	15%	70%

Course Title: Aptitude and Reasoning Development - BEGINNER. (ARDB)			
Course Code : P15HU39	**Semester : III**	**L - T - P : 0 - 0 - 2**	**Credits: NA**
Contact Period: Lecture: 32 Hrs, Exam: 3 Hrs		**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. Analyse 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

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

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. **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. **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.

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. **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. **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 Title : Additional Mathematics-I (A Bridge course for Diploma qualified students of III Sem. B. E.)			
Course Code : P15MADIP31	**Semester : III**	**L :T:P:H : 2:2:0:4**	**Credits: NA**
Contact Period: Lecture: 52 Hrs,		**Weightage: CIE:100%, [P/NP]**	

Course contents

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.

Course Title: Indian Constitution, Human Rights and Professional Ethics (A course for Diploma qualified students of III Sem. B. E.)			
Course Code: P15HMDIP310	**Semester :** III	**L-T-P-H:** 2–0-0-0-2	**Credits:** NA
Contact Period : Lecture :26 Hr		**Weightage :** CIE:100% - [P/NP]	

COURSE CONTENT

I. Indian Constitution:

1. Introductory Part - The preamble, Fundamental rights
2. Directive principles of state policy - and fundamental duties
3. The union executive, union legislature and the union judiciary
4. The state executive, state legislature and the high court in the states
5. Special provision for scheduled caste and scheduled tribes
6. Election commission - Functions - Emergency provisions and amendment of the constitution

II. Human rights:

Aims and objectives to create responsible citizenship with awareness of human rights and latest development.

1. Protection of human rights and protection of human rights act - 1993
2. Human right - with related to rights of women, children disabled, tribal's, aged and minorities

III. Professional Ethics:

1. Aims, objects - advantages with national and international, recent development.

4th SEMESTER

Course Title: Engineering Mathematics-IV (Common to E&C, E&E, CS&E and IS&E Branches)		
Course Code: P15MAES41	**Semester: 4**	**L – T – P – H : 3 –2 – 0 – 5**
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. 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.
2. Learn logical thinking and analytical /geometrical skills in linear algebra through vector spaces, basis, dimension and linear transformations along with construction a matrix of linear transformations with respect change of bases of same or different dimensions. Understand iterative methods in linear algebra such as Gauss-Jacobi, Gauss -Seidel, Relaxation and Power method and their practical utility in engineering fields.
3. 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
4. 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.
5. 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.
   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 solving algebraic, transcendental and ordinary differential equations arising in various engineering flow and design data problems.

In linear algebra deals with vector space, subspace, Rank and nullity, linear Transformation related to engineering problem

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.

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

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

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

Course Content

UNIT-I

Numerical Methods-II: Solution of algebraic and transcendental equations : Bisection method, Regula-Falsi method, Newton–Raphson method and 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 and first degree – Introduction. Taylor's series method. Euler's and modified Euler's method. Runge - Kutta method of IV order. Milne's and Adams predictor & corrector methods (All formulae without proof) - Illustrative examples from engineering field. **10Hrs**

UNIT-II

Linear Algebra-II: Introduction to vector spaces – subspaces, linearly independent/dependent sets ; Bases and dimension. Linear transformation - rank and nullity. Change of basis. Matrix of linear transformations. (No proof for theorems/properties) - Illustrative examples from engineering field.

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 **10 Hrs**

UNIT-III

Complex Analysis: Introduction to functions of complex variables. Definitions- limit, continuity and differentiability. Analytic functions. Cauchy–Riemann equations in Cartesian and polar forms, 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 = $z+\frac{1}{z}(z\neq 0)$ and Bilinear transformations.

Complex integration: Complex line integrals. Cauchy's theorem, Cauchy's integral formula. Taylor's and Laurent's series (Statements only).and problems. Singularities, poles and residues. Cauchy's residue theorem (statement only). Simple illustrative examples.**11 Hrs**

UNIT-IV

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. **11 Hrs**

UNIT – V

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.

Series solutions of ODE's and special functions: Series solution-Frobenius method. Series solution of Bessel's equation 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. **10 Hrs**

Text Books:

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

References:

1. T. Veerarajan : Engineering Mathematics, Tata McGraw-Hill Pub.,2003.

2. Introductory Methods of Numerical Analysis: - S.S.Sastry, PHI, 3rd Ed.2000.
3. Linear Algebra and its applications: - David C.Lay, Pearson Education Ltd., 3rd Edition, 2003.
4. Seymour Lipschutz : Probability:-, Schaum's outline series, McGraw-Hill Pub., 2nd Ed, 2002.

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. 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.
2. Describe the concept of vector space, subspace, basis, dimension and their practical utility in matrix of linear transformations required in the area of graphics, analysis of graphs, internet search, machine learning and scientific computing etc. And, 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.
3. 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.
4. 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
5. 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.
   Obtain series solution of essential ODE's such as Bessel's and Legendre's differential equations and understand their scientific/engineering utility

Engineering Mathematics-IV(P15MAES41)			
Time- 3Hrs			**Max. Marks- 100**
Note: Answer any FIVE full questions choosing at least one full question from each unit			
Model Question Paper	Marks	CO's	Levels
UNIT- I			
1. a) Using Regula–Falsi method find the approximate root of the equation $x log_{10} x = 1.2$ (perform three iterations)	6	1	L2
b) Use Newton – Raphson method to find a real root of $x\sin x + \cos x = 0$ near $x = \pi$. Carry out the iterations upto four decimal places of accuracy.	7	1	L2
c) Find the smallest root of the equation $x^2 + 2x - 2 = 0$, using fixed point iteration method and accelerate the convergence by Aitken's Δ^2 – method.	7	1	L2
2. a) From Taylor's series method, find $y(0.1)$ considering upto fourth degree term if $y(x)$ satisfies the equation $\frac{dy}{dx} = x - y^2, y(0) = 1$	6	1	L2
b) Using modified Euler's method find y at $x = 0.2$ given $\frac{dy}{dx} = 3x + \frac{1}{2}y$ with $y(0) = 1$ taking $h = 0.1$. Perform three iterations at each step	7	1	L3
c) Apply Milne's method to compute $y(1.4)$ correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and the data: $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.4649$, $y(1.3) = 2.7514$	7	1	L2

UNIT- II			
1. a) Define (i) vector space and (ii) subspace with suitable examples.	6	2	L2
b) Define basis of a vector space. Is the set $\{(1,1,2),(-3,1,0),(1,-1,1),(1,2,-3)\}$ a basis for the vector space $R^4(R)$?	7	2	L2
c) Define a linear transformation. Find the matrix of linear transformation $T: V_2(R) \to V_3(R)$ defined by $T(x,y) = (x+y,\ x,\ 3x-y)$ with respect to bases $\{(1,0),(0,1)\}$ and $\{(1,1,0),(1,0,1),(0,1,1)\}$	7	2	L3
2. a) Solve the system of the equations $x + y + 54z = 110$, $27x + 6y - z = 85$, $6x + 15y + 2z = 72$ by Gauss –Seidel method to obtain the numerical solution correct to three places of decimals.	6	2	L2
b) Solve the system equations $2x_1 + 8x_2 - x_3 = 24; 12x_1 + x_2 + x_3 = 31;$ $3x_1 + 4x_2 + 10x_3 = 58$ by relaxation method?	7	2	L2
c) Find the dominant eigen value and the corresponding eigen vector of A= $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by Power method taking the initial eigen vector a $[1,1,1]^T$	7	2	L2

UNIT- III			
5 a) If $\phi + i\psi$ represents the complex potential of an electrostatic field where $\psi = (x^2 - y^2) + \frac{x}{x^2 + y^2}$, find ϕ and also the complex potential as a function of the complex variable z.	6	3	L2
b) Discuss the transformation $w = z + 1/z$, $z \neq 0$.	7	3	L3
c) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into $w = -1, -i, 1$. Also find the invariant points of the transformation.	7	3	L3
6 a) Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along (i) the line $x = 2y$ (ii) the real axis up to 2 and then vertically to $2+i$.	6	3	L2
b) Expand $f(z) = \frac{z+1}{(z+2)(z+3)}$ as Laurent's series in the regions (*i*) $\|z\| > 3$ *and* (*ii*) $2 < \|z\| < 3$.	7	3	L3
c) Evaluate $\int_C \frac{e^{2z}}{(z+1)^2(z-2)} dz$ where C is the circle $\|z\| = 3$ by Cauchy residue theorem.	7	3	L3

UNIT- IV

7. a) The first four moments about an arbitrary value 5 of a frequency distribution are -4 , 22, -117 and 560. Find the skewness and kurtosis based on moments. — 6 | 4 | L1

b) Fit a best fitting parabola $y = a + bx + cx^2$, by the method of least squares for the data: — 7 | 4 | L2

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

c) The following data gives the age of husband (x) and the age of wife (y) in years. Find the correlation coefficient and hence obtain the regression lines. Also calculate the age of husband corresponding to wife of 16 years age : — 7 | 4 | L2

x	36	23	27	28	28	29	30	31	33	35
y	29	18	20	22	27	21	29	27	29	28

8. (a) Find the value of k such that the following distribution represents a finite probability Distribution: — 6 | 4 | L2

x	-3	-2	-1	0	1	2	3
$p(x)$	k	$2k$	$3k$	$4k$	$3k$	$2k$	k

Also, find $P(x \le 1), P(x > 1)$ *and* $P(-1 < x \le 2)$

(b) The number of telephone lines at an instant of time is a binomial variate with probability 0.1 that a line is busy. If 10 lines are chosen at random , what is the probability that (i) no line is busy (ii)all lines are busy (iii)at least one line is busy (iv)almost 2 lines are busy — 7 | 4 | L2

(c) State probability density function of Gaussian (normal) distribution. An analog signal received at a detector (measured in micro-volts) may be modeled as a Gaussian random variable with mean 200 and variance 256 at a fixed point of time. What is the probability that the signal will exceed 240 micro-volts? — 7 | 4 | L3

UNIT- V

9. a) A random variable of X and Y having the following joint distribution — 6 | 5 | L2

X \ Y	-3	2	4
1	0.1	0.2	0.2
2	0.3	0.1	0.1

Find (i) Marginal distributions of X and Y (ii) Cov (X,Y) (iii) Are the variables X,Y statically independent?

b) Define (i) stochastic matrix (ii) regular stochastic matrix. Find the unique probability vector for the regular stochastic matrix $\begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ — 7 | 5 | L3

c) Verify that $f(x,y) = \begin{cases} e^{-(x+y)}, & x \ge 0,\ y \ge 0 \\ 0, & otherwise \end{cases}$ is a probability density function of two - dimensional probability function. Evaluate $P(x<1), P(x \le y)$ and $P(1/2 < x < 2,\ 0 < y < 4)$ — 7 | 5 | L2

10.a) Develop a series solution of the equation $(1+x^2)y'' + xy' - y = 0$ — 6 | 5 | L3

b) Solve the Bessel's differential equation : $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$)

c) Express $4x^3 - 2x^2 - 3x + 8$ in terms of Legendre's polynomials. — 7 | 5 | L3

	7	5	L2

Course Plan			
Course Title: Analog Communication			
Course Code: P15EC42	**Semester: 04**	**L – T – P : 4 – 0 - 0**	**Credits:4**
Contact Period - Lecture:52Hrs.;Exam: 3Hrs.	**Weightage: CIE: 50%;**		**SEE: 50%**

Prerequisites:

1. Signals and Systems -P15EC36
2. Engineering Mathematics-III -P15MAT31

Course Learning Objectives (CLOs):

This Course aims to:

1. Provides the basic knowledge of random variables, random process, autocorrelation and cross-correlation function, Gaussian process and its properties.
2. Describe the communication, elements of communication system, Modulation, generation and detection of AM wave, Hilbert transform and its properties.
3. Explain the DSBSC and SSBSC modulation techniques, generation and detection of DSBSC and SSBSC, as well as Frequency Translation and FDM
4. Discuss the VSB modulation technique, comparison of amplitude modulation techniques, as well color television and high definition TV.
5. Illustrate the significance of angle modulation, frequency deviation, modulation index, narrow band and wide band modulation.
6. Understand the transmission BW, generation of FM wave, demodulation of FM signals, non linear effects in FM systems, FM stereo multiplexing and super heterodyne receiver
7. Classify the different types of noise, noise in continuous-wave modulation systems, pre – emphasis and de –emphasis in FM.

Relevance of the Course:

1. Optical Communication System -P15EC51.
2. Digital Communication (FC-2) –P15EC64
3. Satellite Communication -P15EC821

Course Content

UNIT 1

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

Amplitude Modulation: Introduction to communication, Elements of communication system, Definitions: Modulation and demodulation, Amplitude Modulation: time domain and frequency domain description,single tone modulation, efficiency of modulation, Generation of AM wave: Square Law Modulator andSwitching Modulator. Detection of AM waves: square law detector and envelope detector, Hilberttransform and its properties.

Text1: 1.1, 1.4, 7.1

Text2: 2.10, 4.3, 4.6, 4.8, 4.12. **11Hrs**

UNIT 2

DSB-SC Modulation: Time domain and frequency domain description, Generation of DSBSC wave: balanced modulator and ring modulator, Demodulation of DSBSC wave: Coherent detection of DSBSC modulated waves and Costas loop, Quadrature-carrier multiplexing, Frequency Translation

Single- sideband Modulation: Time-Domain and frequency domain description of SSB waves, single tone modulation, generation of SSB waves: frequency discrimination and phase discrimination method, Coherent detection of SSB waves, FDM.

Text1:7.2, 7.3, 7.7, 7.4, 7.8 **10Hrs**

UNIT 3

Vestigial side band modulation: Time domain and frequency domain description,Generation of VSB modulated waves, envelope detection of a VSB wave plus carrier, comparison of amplitude modulation techniques, application: color television and high definition TV.

Angle Modulation: Time domain representation of PM and FM waves, Frequencymodulation: Frequency deviation and modulation index, Narrow band frequency modulation, Wideband Frequency Modulation, average power in FM.

Text1: 7.5, 7.6, 7.9.

Text2: 3.10, 3.11 **10Hrs**

UNIT 4

Transmission BW of FM signals, Generation of FM wave: Indirect and direct Methods Demodulation of FM signals: frequency discrimination and balanced frequency discriminator, FM Stereo Multiplexing, phase locked loop, nonlinear model of phase locked loop, linear model of the phase locked loop, non linear Effects in FM systems, the super heterodyne receiver.

Text2: 3.11, 3.12, 3.13, 3.14 **10Hrs**

UNIT 5

Noise: External Noise, Internal Noise, Shot noise, Thermal noise, White noise, Noise Equivalent Bandwidth, Narrowband noise, Noise figure, Equivalent noise temperature, Cascade connection of two-port networks.

Noise in continuous-wave modulation systems: Introduction, Receiver model, Noise in DSB –SC receivers, Noise in SSB receivers, Noise in AM receivers, Noise in FM receivers, FM Threshold effect, Pre –emphasis and De – emphasis in FM

Text2: 4.13, 4.14, Appendix 6, 5.1 to 5.7 **11Hrs**

Text Books

1. Simon Haykin, “An Introduction to Analog and Digital communications”, John Wiley and Sons Pte Ltd.
2. Simon Haykins , “Communication Systems”, 5th Edition, John Willey and Sons Pte Ltd.

Reference

1. P Ramakrishna Rao, “Analog Communications” , Tata McGraw Hill.

Course Outcomes

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

1. Describe the random process, autocorrelation, cross-correlation functions and Gaussian process – L2 (Unit - I)

2. Explain the AM modulation, its generation, its detection, Hilbert transforms and its properties – L2 (Unit – I)
3. Discuss the DSBSC and SSBSC modulation, its generation, its detection, Frequency Translation and FDM– L5(Unit – II)
4. Explain the VSB modulation, angle modulation, color and high definition TV – L2 (Unit – III)
5. Describe the demodulation of FM waves, PLL, Non-linear effects in a FM system and supe heterodyne receiver.– L2 (Unit – IV)
6. Discuss the different types of noise in communication systems, Noise in continuous-wave modulation systems and Pre –emphasis and De – emphasis in FM System – L5 (Unit – V)

Model question paper

Questions	Marks	CO's	Levels
Unit-1			
1. a) Define autocorrelation. List the properties of autocorrelation function	7	1	L1
b) Compare the Mean, correlation and covariance function	7	1	L1
c) Discuss the Gaussian Process and its properties	6	1	L2
OR			
2. a) A information signal has the following time-domain form $m(t)= A_{m1}\cos(2\pi f_1 t)+A_{m2}\cos(2\pi f_2 t)$ Volts. Where $A_{m1}>A_{m2}$, $f_2>f_1$	7	1	L3
i. Discover the time-domain expression for AM wave.	6	1	L2
ii. Sketch the spectrum for the AM wave obtained in part (i) and find BW	7	1	L2
b) Explain the generation of AM wave using switching modulator			
c) Explain the envelope detector with relevant diagram and waveforms			
Unit-2			
3. a) Describe the time and frequency domain equation for DSBSC wave	7	2	L2
b) Discuss the concept of Frequency Translation.	6	2	L3
c) What is Costas loop? Explain its working principle	7 4	2 2	L1 L2
OR			
4. a) Outline the advantage of SSBSC over DSBSC and AM waves	8	2	L2
b) Explain the phase discrimination method for generating an SSB modulated wave	8	2	L2
c) Draw the block diagram of FDM. Explain each block			
Unit-3			
5. a) What is VSBSC? Explain how VSBSC signal is obtained from a modulating signal m(t) using a carrier c(t) using filtering technique	10	3	L2
b) Write the block diagram of multiplexor in TV transmitter. Explain	10	3	L2
OR			
6. a) Explain modulation index and frequency deviation in FM	6	3	L2
b) Derive the time domain equation of NBFM wave	8	3	L3
c) An unmodulated carrier has amplitude 10 volts and frequency100MHz. A sinusoidal waveform of frequency 1 KHz, frequency modulates this carrier	6	3	L4

such that the Frequency deviation is 75 KHz. The modulated waveform passes through zero and is increasing at time t= 0. Write the time-domain expression for the modulated carrier waveform			
Unit-4			
7. a) Describe the direct Methods of generating FM wave	10	4	L2
b) Define the PLL. Explain the nonlinear model of the phase locked loop.	10 10	4 4	L2 L2
OR			
8. a) Explain the super heterodyne receiver	10	4	L2
b) Explain the FM stereo multiplexing			
Unit-5			
9. a) Define the noise and Discuss the different types of external Noise	10	5	L2
b) List the types of internal noise.	4	5	L1
c)Describe the Noise Equivalent Bandwidth	6	5	L2
OR			
10. a) Show that FOM for DSBSC receiver is unity	10	5	L3
b)Describe the Pre – emphasis and De – emphasis in FM	10	5	L2

Course Plan			
Course Title: POWER ELECTRONICS			
Course Code: P15EC43	**Semester: IV**	**L – T – P : 4 – 0 - 0**	**Credits: 4**
Contact Period - Lecture:52Hrs.;Exam: 3Hrs.	**Weightage: CIE: 50% SEE: 50%**		

Prerequisites:

1. Electronic devices and Communication -P15EC25
2. Engineering Mathematics-II -P15MAT21

Course Learning Objectives (CLOs):

This Course aims to;

1. Discuss the different types of power semiconductor devices, its characteristics and applications.
2. Provide the knowledge ofthyristor, its types, characteristics and firing circuit.
3. Understandthe operation of AC voltage controllers and controlled rectifiers.
4. Explain the concept of DC choppers, its types and applications.
5. Analyse the inverter operation, its performance parameters and different applications of power electronics.

Relevance of the Course:

1. Analog electronics circuits -P15EC32
2. Digital CMOS VLSI circuits -P15EC52
3. Control systems -P15EC54

Course Content

UNIT-I

Introduction to Power Semiconductor devices: Applications of Power electronics, power semiconductor devices, Control characteristics, Types of Power electronic circuits, Peripheral effects.

Power Transistors : BJT's, Steady state characteristics Switching characteristics, Switching limits, power MOSFET's switching Steady state characteristics , IGBT's, di/dt and dv /dtlimitations, Isolation of gate and base drives.

Text 1: 1.1, 1.2, 1.3, 1.5, 1.8, 4.1, 4.2, 4.3, 4.6, 4.8, 17.4 **11hours**

UNIT – II

Thyristors: Introduction, characteristics, two transistor models, turn on and turn off times of an SCR, Thyristor types di /dt and dv /dt Protection Thyristor types – series and parallel operation of SCR – Thyristor firing circuits.

Text1:7.1 to 7.10, 17.5 **10hours**

UNIT – III

AC Voltage Controllers: Introduction, Principles of ON– OFF and Phase control, single Phase bi directional controllers with resistive and inductive loads. Controlled Rectifiers: Introduction, Principles of phase controlled converter operation, single phase, full converter and dual converter (constant current operation mode only).

Text1:11.1 to 11.5, 10.1 to 10.4 **11 hours**

UNIT – IV

DC to DC Converter: Introduction , principles of step down Operation , step down Converter With RL load, Principle of step–up Converter , step–up Converter With Resistive load,performance parameters, Converter classification.

Text1:5.1 to 5.7 **10hours**

UNIT – V

Inverters: Introduction, principles of operation, performance parameters, single phase bridge inverters, voltage control of single phase inverters, current source inverter.

Power Electronic Applications: Introduction, Uninterruptible Power supply, Switched Mode Power Supply (SMPS), High voltage D.C Transmission, Switch Mode welding, Electronic Lamp Ballast, and Battery Charger.

Text 1:6.1, 6.2, 6.3, 6.4,6.6, 6.10. **10hours**

Text 2:16.1, 16.2, 16.3, 16.4, 16.7, 16.8, 16.9

TEXT BOOKS:

1. **M.H. Rashid, "Power Electronics" ,** Prentice Hall of India Pvt. Ltd/ Pearson New Delhi Feb 2002, 3rd edition.
2. **M.D Singh and K.B Khanchandani, "Power Electronics",** McGraw Hill Education (India) Private limitedNew Delhi 2007, 2nd edition.

REFERENCE BOOKS:

1. **Cyril .W. Lander "Power Electronics"** McGraw HillPublisher, 3rdedition.
2. **R.S. Anand Murthy and V.Nattarasu**, **"Power Electronics" ,**Sanguine Technical Publishers, Bangalore, 2nd edition.
3. **Joseph Vithayathil, "Power Electronics"** McGraw Hill Education (India) Private limited New Delhi 2010.

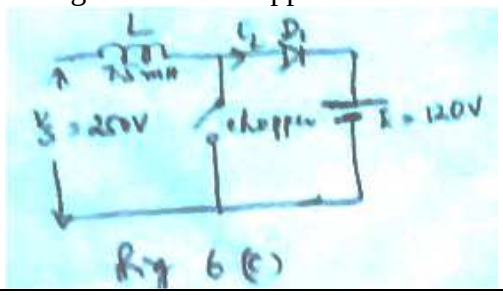
Course Outcomes

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

1. Describe the working of semiconductor devices and its characteristics. – L1 (Unit – I)
2. Discuss thethyristor types, characteristics and firing circuit. – L2 (Unit – II)
3. Design the AC voltage controllers with resistive and inductive load. – L5 (Unit – III)
4. Develop the expressions for voltage and current for dc to dc converter circuits. – L5 (Unit – III)
5. Solve the problems on step up and step down chopper. – L3 (Unit – IV)
6. Describe the inverter operation and power electronics applications. – L1 (Unit – V)

Model Question Paper

Model Questions	Marks	BTL	CO
UNIT-I			
1. (a) Define power converter? List different types of power converter and mention their conversion function.	**08**	**L1**	**CO1**
(b) List the peripheral effects of power converter system. What are remedies for them?	**06**	**L1**	
(c) With the help of neat diagrams and relevant waveforms briefly explain the control characteristics of the following power devices. i) SCR ii) GTO iii)Power BJT	**08**	**L2**	
OR			
2. (a) Draw the switching model and switching waveform of a power MOSFET and hence define its switching times.	**08**		
(b) In an anti saturation control circuit V_{CC} =120V, RC=2 Ω, V_{D1}=2.1V, V_{D2}=0.9V, V_{BE}=0.7V, V_{BB}=14V, RB=3Ohm and β=15 determine i) Collector current without clamping ii) Collector clamping voltage iii) Collector current with clamping.	**08**	**L5**	
(c) Draw the circuit symbol of IGBT. Compare the IGBT with power BJT and power MOSFET.	**04**		
UNIT-II			
3. (a) With relevant waveforms explain the turn on and turn off characteristics of thyristor and thus define the turn on and turn off time.	**08**	**L2**	**CO2**
(b) Using two transistor analogy, develop an expression for anode current of thyristor.	**08**	**L3**	
(c) Distinguish between i) Latching current and holding current of thyristor. ii) Phase controlled and fast switching thyristors.	**04**	**L4**	
OR			
4. (a) Ten thyristors are used in a string to withstand a DC voltage of V_s =15kV. The max leakage current and recovery charge differences of thyristors are 10mA and 150μC respectively .Each thyristors has a voltage sharing resistance of R=56k and capacitance C_1 = 0.5. Determine (i) Max study state voltage sharing $V_{DS(MAX)}$, (ii) Steady state voltage derating factor ,(iii) Max transient voltage sharing $V_{DT(MAX)}$,(iv) transient voltage dealing factor.	**08**	**L5**	
(b) Explain the need to protect thyristor against high $\frac{di}{dt}$ and $\frac{dv}{dt}$. Discuss the normally employed methods.	**06**	**L2**	
(c) Explain UJT firing circuit in brief with suitable waveforms.	**06**	**L2**	
UNIT-III			
5. (a) A single phase half wave controlled rectifier has transformer secondary voltage of 230V at 50 Hz. The load resistance R=10ohm. If the delay angle of thyristor is α = π/2 Determinei) Rectification efficiency ii) Form factor iii) Ripple factor iv) Transformer utilization factor.	**10**	**L5**	**CO3**
(b) With help of neat circuit diagram and relevant waveforms. Explain the working of single phase bidirectional AC voltage controller with inductive load. Develop the expression for its RMS output voltage.	**10**	**L2, L3**	

OR			
6. **(a)** Explain the working of single phase dual converter with relevant waveforms. List the advantages and disadvantages of circulating current.	**10**	**L2,L1**	
(b) A single phase half wave controlled rectifier has a transformer secondary voltage of 230V, 50Hz and supplies a purely resistive load of R=10Ω. If the average output voltage is 75% of the max possible average output voltage. Determinei) the delay angle of the thyristor ii) the RMS and average values of the output current iii) the average and RMS values of thyristor current iv) the input power factor.	**10**	**L5**	**CO4**
UNIT-IV			
7. **(a)** Develop an expression for peak to peak load current in step down chopper with inductive load.			
(b) In a step down chopper source voltage is 220V DC. The load circuit parameters are R=10Ω and L = 5mH. If the chopper is operation at a frequency of 200Hz and on/off ratio of chopper is 2:1.Determine (i) Average load current, (ii) Max and min values of instantaneous load current under steady state conditions.	**10**	**L3**	
OR			
8. **(a)** Explain different classification of chopper.	**10**	**L5**	
(b) List any two applications of step up chopper. In the step chopper of fig 6(c) E = 120V and V =250V. If the average power delivered to the battery E is 25kW, Determine (i) The duty cycle, (ii) The effective load resistance of the chopper, (iii) The average value of the source current. Neglect the load ripple current.	**10**	**L2**	**CO5**
	**10**	**L1, L5**	
UNIT-V			
9. **(a)** With the help of a neat circuit diagram and relevant waveforms explain the working of a single phase full bridge converter.	**10**	**L2**	
(b) A single phase full bridge inverter has resistive load of R=5Ω and DC input voltage is v/2=30V. Calculate (i) RMS output voltage at fundamental frequency V1, (ii) Output power, (iii) Average current of each switch, (iv) Total harmonic distortion and distortionfactor.	**10**	**L5**	
OR			
10. **(a)** List the normal specification of industrial power supplies.	**06**	**L1**	
(b) With neat relevant diagram and relevant waveform explain play back converter.	**08**	**L2**	**CO6**
(c) With neat circuit diagram explain a bidirectional AC power supply.	**06**	**L2**	

Course Plan		
Course Title: **Digital Signal Processing**		
Course Code: **P15EC44**	Semester: **IV**	L – T – P : 4 – 0 - 0
Contact Period - Lecture:52Hrs.;Exam: 3Hrs.	Weightage: CIE: 50% SEE: 50%	

Prerequisites:

1. Signals and Systems. - P15EC36
2. Engineering Mathematics. - P15MAT21

Course Learning Objectives (CLOs):

This Course aims to;

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

Relevance of the Course:

1. Digital Image Processing – P15EC72
2. Digital Signal Processor and Applications – P15EC753

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.

Text1:7.1.1 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 Chebyshevfilters, 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
Text1: 9.1, 9.2, 9.3
Text2: 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.
2. Digital signal Processing –A.Nagoor Kani, McGrawhill education, 2nd edition, NewDelhi 2012

REFERENCE BOOKS:

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
2. Digital Signal Processing, S. K. Mitra, Tata Mc–Graw Hill, 3rd Edition, 2007.
3. Digital signal processing, Lee Tan, Elsevier publications, 2007

SELF LEARNING COMPONENTS (Using MATLAB or SCILAB or any similar tools):

Unit-I

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-II

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-III

1. Design a 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.
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 ChebyshevanalogBand-stop 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-IV

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-V

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. A filter is described by y(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.

Course Outcomes

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

1. Understand importance of DFT, properties of DFT and its use in linear filtering – L2 (Unit – I)
2. Apply the fast Fourier Transform to compute DFT – L3 (Unit – II)
3. Design the FIR filters for given specification. – L5 (Unit – III)
4. Design the IIR filters from analog filters for given specification. – L5 (Unit – IV)
5. Implement the discrete–time systems using various approaches– L4 (Unit – V)
6. Understand role of DSP in various applications -L2(Unit – V)

Model Question Paper

Model Questions	Marks	BTL	CO
UNIT-I			
11. (a) State and prove circular frequency shift property of DFT	**08**	**L2**	
(b) Find x(n) if X(k)= { 4, 3-j3,2,3+j3) using formula	**04**	**L1**	
(c) Compute the 8 point DFT of x(n) =$(-1)^{n+1}$. $0 \leq n \leq 7$. Also Plot magnitude and Phase plot of DFT	**08**	**L3**	
OR			
12. (a) Determine the Circular Convolution of two sequences $x_1(n)$ = { 1, 2,-1,-1} and $x_2(n)$ ={ -3,-2,-1,0} using time domain approach and verify the result using DFT and IDFT method	**10**	**L2**	**CO1**
(b) Consider a FIR filter with an impulse response h(n) = {3,2,1,1}. If the input is x(n) = {1,2,3,3,2,1,-1,-2,-3,5,6,-1,2,0,2,1}. Find the output using overlap add method assuming block length of 7. .	**10**	**L5**	
UNIT-II			
13. (a) State and Prove the Goertzel algorithm	**10**	**L3**	
(b) List the difference between DIT-FFT and DIF-FFT radix 2 algorithm	**04**	**L1**	
(c) Compute the 8 point DFT of the sequence $x_1(n)$ = {1,3,4,5,3,2,1,3} using DIF FFT algorithm	**06**	**L3**	**CO2**
OR			
14. (a) Derive the Radix-2 DIF FFT algorithm to compute DFT of an N=8 point sequences and draw the signal of flow graph	**10**	**L4**	
(b)Find the IDFT of X(K) ={0,2+2j,-4j,2-2j,0, 2+2j, j4, 2 -2j }using inverse Radix -2 DIT FFT algorithm	**10**	**L5**	
UNIT-III			

15. (a)Design a low pass filter with a cut off frequency $w_c = \pi/4$, transaction width, $\Delta w=0.02\pi$ and a stop band ripple, $\delta_s= 0.01$ using Kaiser window	**10**	**L5**	
(b)Design a LP FIR visiting frequency sampling method . The filter should have cut off frequency of $\pi/2$ rad/sec. The filter should have linear phase and length 17	**10**	**L5**	**CO3**
OR			
6. (a) With necessary mathematical analysis explain frequency sampling technique of FIR filter design	**10**	**L3**	
(b) Using rectangular Window technique, design a low pass filter with pass band gain of unity cut off frequency of 1000 Hz and working at a sampling frequency of 5 KHz. The length of impulse response should be 7.	**10**	**L5**	**CO3**
UNIT-IV			
7. (a) A third order Butterworth low pass filter has the system transfer function given as $H(s)= \frac{1}{(s+1)(s^2+s+1)}$ obtain H(z) using impulse invariance method	**08**	**L3**	
(b) Using bilinear transformation $s = \frac{1-\frac{1}{z}}{1+\frac{1}{z}}$ find the image of $s= e^{j\pi/2}$ in the Z plane	**08**	**L3**	**CO4**
(c) List the differences between Impluse Invariant techniques and Bilinear transformation	**04**	**L1**	
OR			
8. (a) Design a digital IIR Butterworth filter that has a 2 dB passband attenuation at a frequency of 300π rad/sec ant atleast 60 dB stop band attenuation at 4500 π rad/sec. Use backward difference transformation	**08**	**L2**	
(b) Design the digital filter using chebyshev approximation and bilinear transformation to meet the following specifications Passband ripple =1 dB for $0\leq\omega\leq0.15\pi$ Stopband attenuation $\geq$ 20 dB for $0.45\pi\leq\omega\leq\pi$	**12**	**L5**	
UNIT-V			
9. (a) Rewrite the following system function defined by $H(z)=\frac{(1+z^{-1})(1+2z^{-1})}{(1+0.5z^{-1})(1-0.25z^{-1})(1+0.125z^{-1})}$ In parallel form with neat structure	**08**	**L4**	**CO5**
(b)The transfer function of a discrete causal system is given as follows: $H(z)=\frac{1-z^{-1}}{(1-0.2z^{-1}-0.15z^{-2})}$ i) Find the difference equation for the transfer	**12**	**L5**	**CO5**

ii) Draw cascade and parallel realization iii) Calculate the impulse response of the system			
OR			
10. (a) Obtain the direct form I, direct form II and cascade form realization of the following function $H(z)=\frac{8z^3-4z^2+11z-2}{(z-0.25)(z^2-z+0.5)}$	**12**	**L4**	**CO5**
(b) Explain application of DSP with respect to biomedical signal Processing	**08**	**L2**	**CO6**

Course Plan			
Course Title: Microcontroller			
Course Code: P15EC45	**Semester: 4**	**L – T – P : 4 – 0 - 0**	**Credits: 4**
Contact Period - Lecture: 52 Hrs.; Exam:3 Hrs.	**Weightage: CIE: 50%; SEE: 50%**		

Prerequisites:

1. Electronic Devices and communication– P15EC15/25
2. Digital Electronics Circuits Design - P15EC33

Course Learning Objectives

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.

Relevance of the Course:

1. Embedded and Real Time Systems(HC)- P15EC73
2. Embedded Systems-P15EC842

Course content (Syllabus)

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, 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7. **11hours**

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: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8. **11hours**

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: 6.1, 6.2, 6.3, 6.4, 6.6, 6.7, 6.8, 6.9, 6.10. **10hours**

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: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.9, 8.10, 8.11. **10 hours**

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: 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7. **10hours**

Self learning components

Study of assembly language/ c-programming tools with programming exercises.

TEXT BOOKS:

1. John Davies, "MSP430 **Microcontrollers Basics**", Newnes (Elsevier Science), 2008.

REFERENCE :

www.elsevierdirect.com/companions/9780750682763

Course Outcomes

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

1. Analyze the Embedded System and different types of Microcontrollers. [Unit I]L1
1. Explain the functional blocks and pin configuration of MSP430. [Unit I]L2
2. Describe the architecture of MSP430. [Unit II]L2
3. Explain and use the Interrupts and write subroutines of MSP430. [Unit III] L3
4. Use inbuilt Timers and counters with different modes of operation. [Unit IV] L3
5. Program different types of conversions like A/D and D/A . [Unit V]L4

Model Question Paper

Q.NO	QUESTIONS	MARKS	CO'S	LEVELS
1(a)	Explain the role of microcontroller in embedded system with an application.	06	1	L3
(b)	Explain the memory map of MSP430.	08	2	L2
(c)	Distinguish between Harvard and von Neumann Architecture.	06	1	L2
	OR			
2(a)	Discuss the different types of non-volatile memory.	06	1	L2
(b)	Explain registers in the CPU of MSP430	08	2	L1
(c)	Explain the functional block of MSP430.	06	2	L3
3(a)	Describe the different addressing modes of MSP430.	10	3	L3
(b)	Explain logical shift, arithmetic shift and rotation	6	3	L2
(c)	Distinguish between RISC and CISC architecture	4	3	L2
	OR			
4(a)	Discuss the stack operation in MSP430	06	2	L2
(b)	Explain conditional and unconditional jumps with an example.	06	2	L2
(C)	Explain power on reset and power up clear	08	2	L2
5(a)	Explain any one application using non maskable interrupt.	10	4	L3
(b)	List and explain the low power modes of operation	10	4	L1
	OR			
6(a)	Explain the concept of subroutine and its importance.	08	4	L3
(b)	Discuss maskable and nonmaskable interrupts	04	4	L1
(c)	Write an ALP for interrupt driven real time clock with external 20hz clock	08	4	L4
7(a)	Explain watchdog timer with an example.	10		L3
(b)	How dc motor speed can be controlled using PWM output explain	10	5	L4
	OR			
8(a)	Discuss state transition table and corresponding state transition diagram for a 2-bit up counter with an enable input.	10	5	L3
(b)	Explain generation of a precise average frequency of 440Hz using a range of frequencies for the timer clock.	10		L3
9(a)	With neat circuit Explain the operation of 4 bit successive approximation ADC	10	6	L2
(b)	Summarize temperature sensor on the ADC12	10	6	L2
	OR			
10(a)	Explain the architecture of ADC10	10	6	L3
(b)	Describe signal to noise ratio and jitter in timing	10	6	L2

OBE CURRICULUM FOR BE PROGRAM		
Course Plan		
Course Title: **ELECTROMAGNETIC FIELD THEORY**		
Course Code: P15EC46	Semester: 4	L – T – P : 4 – 0 - 0
Contact period-Lecture : 52Hr; Exam: 3Hr	Weightage:CIE:50%; SEE:50%	

Prerequisites:
1. Engineering Physics. –P15PH12
2. Engineering Mathematics- II - P15MAT21

Course Learning Objectives

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. Analyze 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.

This course forms a prerequisite course for
1. Optical Communication Systems. -P15EC51
2. Microwave Devices and Integrated Circuits. -P15EC62
3. Satellite Communication. -P15EC821

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 **10Hrs**

UNIT – III

The Steady Magnetic Field: Biot– Savart law, Ampere's circuital law, Curl, StokesTheorem, 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 **10Hrs**

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 **11Hrs**

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 BOOKS:

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

REFERENCE BOOKS:

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

Course Outcomes

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

1. Analyze the static electric field due to different field distribution using coulomb's law, and Gauss law, study of electric flux , flux density and Divergence– L4 (Unit – I)
2. Compute the static electric field potential due to different charge distributions, energy, current and boundary condition, Poisson's and Laplace's Equations. – L3 (Unit – II)
3. Analyze the steady magnetic field using Biot – Savart's law, Ampere's law and Stoke's theorem, magnetic forces and inductances. – L4 (Unit–III)
4. Explain the properties of TEM waves in free space, conductors and dielectric medium, wave reflection, Maxwell's equations.– L2 (Unit –IV)
5. Explain the ground wave, space wave and sky wave propagations. – L2 (Unit – V)

Model Question Paper

Questions	Marks	CO's	Levels
UNIT-1			
1. a. Develop an expression for E considering an infinite sheet charge having uniform charge ρ_s c/m	8	1	L3
b. Two infinite sheet of uniform charge densities $\rho_s=10^{-9}/6\pi$ c/m^2 are located at z=-5m and y=-5m calculate the uniform line charge ρ_l necessary to produce same value of E at(4, 2, 2)m if the line charge is at y=0, z=0.	8 4	1 1	L3 L3
c. A charge of 1c is at (2, 0, 0) what charge must be placed at (-2, 0, 0) which will make y component of total E zero at the point(1, 2, 2)	6	1	L2
OR			
2. a. Discuss the application of Gauss's law for differential volume element.			
b. A point charge of 13μc is located at the origin , a uniform line charge density at 160nC/m lies along x-axis and uniform sheet of charge equal to 45 nC/m^2 lies in the z=0 plane. Compute (1) D at A (1, 4, 2) (2) D at B (3, 2, 4) and (3) Total electric flux leaving the surface of the sphere of 4 radius centred at the origin.	8	8	L3
c. State and prove Divergence theorem.	6	1	L1
UNIT-2			
3. a .Develop the relationship between E and V.	6	2	L3
b. Calculate the energy stored in a system of four identical charges Q=6 nC are placed at the corners of the square of 1m side. What is the stored energy in the system when only two charges at opposite corners are in place	8	2	L3
c. Define a Dipole? Develop the equation for V at the point P located at R_1 and R_2 respectively with respect to the charges	6	2	L1
OR			
4. a. State and prove uniqueness theorem.	8	2	L3
b. Deduce the boundary condition between two perfect dielectrics.	8	2	L3
c. Given vector $E=(12yx^26z^2x)a_x+(4x^3+18zy^2)a_y+(6y^3-6zx^2)a_z$. Check whether it represent a possible electric field.	4	2	L3
UNIT-3			
5. a. State and explain Biot-Savart's law find H due to infinity long straight conductor.	6	3	L2
b. Explain the concept of scalar and vector magnetic potential.	8	3	L1
c. An infinitesimal length 10^{-3}m of wire is located at the point (1,0, 0) and carries a current 2A in the direction of the unit vector a_x. compute the magnetic field intensity due to the current element at the point(0,2,2)	6	3	L3
OR			
6. a. Derive an expression for force on differential current element in a steady magnetic field.	6	3	L3
b. Obtain magnetic torque and magnetic dipole moment for a	7	3	L3

rectangular planar coil carrying current I placed in XY plane and parallel to the magnetic field c. Derive magnetic boundary relations. Calculate the torque about the Z-axis for a conductor located at x=0.4m y=0 and 0<z<2m which carries a current of 5A in a_z direction along the length of the conductor B=2.5a_z Tesla.	7	3	L3
UNIT-4			
7. a.Explain the concept conduction current density and displacement current density.	7	4	L1
b. List the Maxwell's equation both in integral form the differential form.	7	4	L1
c. Show that the fields E=E_m sin x sin t a_y and H=E_m/μ_0 cos x cos t a_z satisfy Maxwell equation.	6	4	L3
OR			
8. a. Explain the propagation of uniform plane wave in free space with necessary equations.	8	4	L1
b. Compute the amplitudes of reflected and transmitted electric fields at the interface of 2 regions. If E_i=1.5 m/V in region 1 for which ε_{r1}=85, μ_r=1, and σ=0 and region 2 is a free space.	6	4	L3
c. for copper σ=58(MS-m^{-1}) for Teflon σ=30(MS-m^{-1}) and ε=2.1 ε_0 . Show that at 1MHz, copper is good conductor and Teflon is a good insulator(good dielectric)	6	4	L3
UNIT-5			
9. a. Calculate the distance beyond which the earth's curvature in to be accounted at: (1)100 KHz (2)1 MHz (3)10 MHz what is the inference?	6	5	L3
b. Explain the super refraction and scattering phenomenon.	7	5	L1
c. Briefly explain ionospheric propagation and derive equation for dielectric constant.	7	5	L1
OR			
10. a. Define and derive the expressions for the following in case of ionospheric propagation:1)Critical frequency 2)Maximum usable frequency.	8	5	L1
b.In an ionospheric wave propagation the angle of incidence made at particular layer, at a height of 200Km is 45^0 with critical frequency 6MHz. Calculate the skip distance.	6	5	L3
c. Discuss the relation between MUF and the skip distance, impact of solar activity	6	5	L2

Course Title: POWER ELECTRONICS LAB			
Course Code: P15ECL47	**Semester: IV**	**L – T – P : 0 - 0 – 3**	**Credits: 1.5**
Contact Period - Lab: 12Hrs.; Exam: 3 Hrs.	**Weightage: CIE: 50 %; SEE: 50%**		

Course Learning Objectives (CLOs):

This Course aims to;

1. Conduct and plot the static characteristics of SCR, IGBT, DIAC and TRIAC.
2. Design a RC, HWR, FWR and UJT firing circuit.
3. Examine the working of chopper and inverter.
4. Demonstrate the speed control of induction motor and DC motor.
5. Conduct the experiment on digital firing circuit.
6. Construct a full controlled bridge circuits and plot the graph of R versus α.

b) Course Curriculum (Syllabus)

EXPERIMENTS:

1. Static characteristics of SCR and DIAC.
2. Static characteristics of TRIAC.
3. Static characteristics of IGBT.
4. Controlled HWR and FWR using RC triggering circuit.
5. Digital Firing Circuit to trigger SCR.
6. Design of Synchronized UJT firing circuit for HWR and FWR circuits.
7. AC voltage controller using TRIAC – DIAC combination.
8. Single phase fully controlled bridge with R and R–L loads.
9. Voltage (Impulse) commutated chopper – both constant frequency and variable Frequency operations.
10. Speed control of separately excited DC motor.
11. Speed control of single phase induction motor.
12. Demonstration of parallel inverters.

Course Outcomes

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

1. Construct a circuit to determine the V-I characteristics of TRIAC, SCR and DIAC.
2. Design and obtain the transfer characteristics and output characteristics of given IGBT.
3. Demonstrate the working of AC voltage controller.
4. Build a Synchronized UJT firing circuit.
5. Develop a fully controlled bridge and speed control of DC motor.
6. Demonstrate the working of DC to DC converter.
7. Demonstrate the working of DC to AC converter with and without freewheeling diode.
8. Design the speed control of induction motor and DC motor.

c) Evaluation scheme

CIE	SEE	Total
50	50	100

CIE

Lab Record	Participation and learning	Test I	Test II
30%	20%	20%	30%

SEE

Write up and procedure	Viva- Voice	Conduction and demonstration of results
15%	15%	70%

Course Plan			
Course Title: Microcontroller lab			
Course Code: P15ECL48	**Semester: 4**	**L – T – P : 0 – 0 - 3**	**Credits:1.5**
Contact Period - Lecture: 36 Hrs.; Exam:3 Hrs.	**Weightage: CIE: 50%;**		**SEE: 50%**

a) Course Learning Objectives

This course aims to

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

b) 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

Course outcomes

After learning all the experiments of the course, the student is able to

1. Write an assembly level program for various arithmetic operation.-L3
2. Write an assembly level program for different code conversion.-L3
3. Summarize the interfacing an LCD unit to MSP430F2013.-L2
4. Examine the speed control of DC motor by using PWM.- L4
5. Construct different waveforms using DAC interface. – L3
6. Demonstrate the measurement of pressure, temperature, weight. –L3

c) Evaluation scheme

CIE	SEE	Total
50	50	100

CIE

Lab Record	Participation and learning	Test I	Test II
30%	20%	20%	30%

SEE

Write up and procedure	Viva- Voice	Conduction and demonstration of results
15%	15%	70%

Course Title : Aptitude and Reasoning Development - INTERMEDIATE (ARDI)			
Course Code : P15HU49	**Semester : IV**	**L - T - P : 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. Identify the assumptions, analyse the given argument and evaluate the inference.
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

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. **6 hrs**

Unit – II

Analytical reasoning 2: The basics of logic, some informal tips, **Assumptions**– Some standard categories of assumptions, Where is the assumption invalid?, **Forcefulness of arguments**– Preliminary screening, Will the results really follow?, Is the result really desirable?, Are the argument and suggested course of action properly related?, **Evaluating Inferences**– A study of key words, How to avoid confusion?, **Evaluating given course of action**– Problem -solution relation, Fact-follow-up action relationship. **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. **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. **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. **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 statements and identify the assumptions and infer the results based on the arguments or premises. 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 Title : Additional Mathematics-II (A Bridge course for Diploma qualified students of IV Sem. B. E.)			
Course Code : P15MADIP41	**Semester : IV**	**L :T:P:H : 2:2:0:4**	**Credits: NA**
Contact Period: Lecture: 52 Hr,		**Weightage: CIE:100%, [P/NP]**	

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.

Course Title : Environmental Studies			
Course Code: P15EVDIP410	**Semester : I/II**	**L-T-P-H: 2–0-0-2**	**Credits: NA**
Contact Period : Lecture :26 Hr		**Weightage :CIE:100% - [P/NP]**	

Prerequisites:

The student should have undergone the course on Environmental Studies (Code: P15EV19/29)

a) ***Course Learning Objectives (CLO) :***

At the end of the course the students should be able to:

1 Explain the need for Environmental Management
2 Implement standard data like water, wastewater and air pollution.
3 Demonstrate the use of standard data to compare with the field data.
4 Choose appropriate data to protect environmental.
5 Design environmental amenities based on the needs.

b) Relevance of the Course

Environmental Studies is a foundation course in BE (Environmental Engineering) program, that builds the program design and implementation competence in student through choice of appropriate areas.

The course aims at developing the understanding variations in water, wastewater and air pollution and also the ability to build new ideas.

Course Content

Unit – I

Environment – Definition, Ecosystem – Balanced Ecosystem, Human activities – Food Shelter, Economic and Social Security. Transportation activities, Environmental impact Assessment, Sustainable Development. **6 Hrs.**

Unit – II

Natural Resources – Water resources – Availability and Quality aspects, Mineral Resources, Forest Wealth, Material Cycles – (Carbon, Nitrogen and Sulphur Cycles) Water borne diseases, water induced diseases, Fluoride problem in drinking water. 5**Hrs.**

Unit – III

Energy – Different types of energy, Conventional and Non-Conventional sources – Hydro Electric, Fossil fuel based, Nuclear, Solar, geothermal, tidal, wind, Biomass and Bio-gas. Hydrogen as an alternative future source of energy. **5 Hrs.**

Unit – IV

Environmental Pollution and their effects. Water pollution, Land pollution, Noise pollution, Public Health aspects. Current Environmental issues of importance: Population Growth, Climate change and Global warming – Effect, Urbanizations industrialization. **5 Hrs.**

Unit –V

Acid Rain, Ozone layer depletion, Animal Husbandry. Environmental protection – Role of Government, Legal aspects, initiatives by Non-Governmental Organizations (NGO), Environmental Education, Women Education. **5 Hrs.**

Text Book:

1)Environmental Studies – Benny Joseph – Tata McGraw Hill – 2005

References:

1)Principles of Environmental Science and Engineering – .VenugopalaRao P, Prentice Hall of India, 2005
2)Elements of Environmental Science and Engineering – Meenakshi P, Prentice Hall of India, 2005
3)Environmental Studies – Anil Kumar D.C, New age International Publishers, 2007