HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.

Electronics and Communication Engineering (ECE)

3rd to 8th Semester

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2024-2025)

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Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	FC	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
2	PC	ECEPC-311	Electronic Devices	3	0	0	3	40	60	100
3	PC	ECEPC-312	Digital System Design	3	0	0	3	40	60	100
4	PC	ECEPC-313	Signals and Systems	3	1	0	4	40	60	100
5	PC	ECEPC-314	Network Theory	3	1	0	4	40	60	100
6	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	ECEPC-311P	Electronic Devices Lab	0	0	2	1	30	20	50
2	PC	ECEPC-312P	Digital System Design Lab	0	0	2	1	30	20	50
3	PC	ECEPC-313P	Signal and System Lab using Matlab/Python	0	0	2	1	30	20	50
Total				**17**	**3**	**6**	**23**	**330**	**420**	**750**

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Semester-IV

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	ECEPC-411	Analog Circuits	3	0	0	3	40	60	100
2	PC	ECEPC-412	Microcontrollers	3	0	0	3	40	60	100
3	PC	ECEPC-413	Analog Communication	3	1	0	4	40	60	100
4	PC	ECEPC-414	Electromagnetic Waves	3	1	0	4	40	60	100
5	ES	CSPC- 414	Introduction to Artificial Intelligence	3	1	0	4	40	60	100
6	HS	IKS-311	Indian Knowledge System	2	0	0	2	40	60	100
Labs:										
1	PC	ECEPC-411P	Analog Circuits Lab	0	0	2	1	30	20	50
2	PC	ECEPC-412P	Microcontrollers Lab	0	0	2	1	30	20	50
3	PC	ECEPC-413P	Analog Communication Lab	0	0	2	1	30	20	50
4	ES	CSPC-414P	AI Lab	0	0	2	1	30	20	50
5	EE	ECEEE-411P	Micro Project	0	0	2	1	60	40	100
Total				**17**	**3**	**10**	**25**	420	480	**900**
UG Diploma Exit Option										
1	EE	ECEEE-415P	**Internship-I (Exit)**	**8 Weeks/ 2 Months**			**6**	50	50	100

Note:-

Those students who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Electronics and Communication Engineering during registration for 4th semester. They will be required to obtain additional 6 credits summer internship (Internship-I (Exit)) of 8-weeks/2-months duration during summer term/summer vacations after 4th semester. The evaluation of such candidates shall be done within the first-two months of the running next semester i.e. 5th sem. The internship shall be completed by student during summer vacations after 4th semester, in local industry, government/private organization, entrepreneurs, craft and skilled persons for on-site experiential learning.

Total Credits earned by the student opting UG Diploma exit after 4th Semester is 47+48+6=101 credits. (i.e. 60% of the total credits to be earned)

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SEMESTER III

MAFC-311 Probability Theory and Statistics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter: Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each (Each subdivided into at least two equal sub-parts) and section E has short answer type questions consisting of six parts of 02 marks each or twelve parts of 01 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the section E will be compulsory. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus

Course Objective:

- To understand the basic probability concepts.
- To have an in-depth knowledge of standard distribution which can describe real life phenomena.
- To understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- To analyse the response of random inputs to linear time invariant systems.

Unit-I:

Probability Theory: Counting principles, probability axioms, sample space and events, conditional probability & Baye's Theorem. Random variable, discrete & continuous probability distribution, expectation, variance, standard deviation. Joint probability distribution, mass function, distribution function, marginal distribution function, covariance.

Probability Distributions: Discrete Probability Distributions: Uniform, Bernoulli, Binomial Distribution and Poisson distribution. Continuous Probability Distributions: Normal and exponential distribution.

Unit-II:

Sampling and Testing of Hypothesis:

Basic sampling models, sampling distribution of mean and standard deviation, testing of hypothesis, level of significance, confidence intervals for known and unknown means, simple sampling of attributes, tests of significance for large samples, comparison of large samples, central limit theorem, test of significance for two large samples. Student's t- test, Chi-square test, Goodness of fit, F-distribution..

Unit-III:

Solution of System of Linear, Transcendental Equations & Interpolation

Bisection method, Regula-Falsi method Newton Raphson's method, Gauss elimination method, LU factorization method.

Introduction to Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Difference operators and relations.

Unit-IV:

Numerical Differentiation& Integration: Numerical differentiation using forward difference, backward difference and central difference formula. Integration by trapezoidal and Simpson's rules $1/3^{rd}$ and $3/8^{th}$ rule.

Numerical Solution of Ordinary Differential Equations: Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge's and Runge- Kutta method..

Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

1. Develop understanding of basics of probability theory.
2. Identify different distribution functions and their relevance.
3. Apply the concepts of probability theory to different problems.
4. Understand different numerical integration techniques, and numerically solve differential equations.

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Textbooks:

1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics (2003), 2nd ed.
2. B.S. Grewal, —Higher Engineering Mathematic, Khanna Publishers.
3. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
4. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989.
5. S.S. Sastry , Introductory Methods of Numerical Analysis, fifth Edition ,PHI learning Pvt. Ltd.

References:

1. Seymour Lipschutz, and John J. Schiller, Introduction to Probability and Statistics, Schaum's Outlines by Mc Graw Hill Education.
2. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
3. H.K. Dass and Rajnish Verma, —Engineering Mathematic, S. Chand Publications.

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ECEPC-311 Electronic Devices							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To introduce the concepts of semiconductor physics.*
- *To understand in detail the specification and various parameters of diodes.*
- *To learn and gain insight into the BJT biasing and stabilization using differentbiasing arrangements and H parameters circuits.*
- *To study the construction, operation and characteristics several special semiconductordevices.*
- *To acquaint the various solid state switching circuits using multivibrators, clipping and clamper circuits.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction to Semiconductor Physics:** Conductivity of insulator, conductor and semiconductor in term of energy bands. Energy bands in intrinsic and extrinsic semiconductors: N type and P type semiconductors, Carrier transport: diffusion current, drift current. **Semiconductor Diodes:** Diode specifications, Diode resistance, Diode junction capacitance, Diode equivalent circuits, Load line analysis of diode circuit, Diode types: Zener, Backward, Schottky, Tunnel.	9
II	**Bipolar Junction Transistor Biasing and Stabilization:** Introduction, Transistor as an amplifier, Concept of operating point, Load line analysis,Different biasing arrangements analysis, Need for biasing. **Hybrid Equivalent Circuit for a Transistor:** Simplified and complete H parameter analysis for CB, CE and CC configuration, Calculation of CB, CE and CC parameters using H parameters.	9

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III	**Field Effect Transistors:** JFET: Construction, Operation, Drain and Transfer Characteristic of JFET, MOSFET Construction and Characteristics. **Special Semiconductor Devices:** Construction, Principle of operation and Characteristics of Photo sensor, Photo conductor, LED, SCR, DIAC and TRIAC. Construction, Equivalent circuit and Characteristics of Uni junction transistor (UJT).	9
IV	**Solid State Switching Circuits:** Switching circuits, Different types of switch, Switching transistor, Switching action of transistor, Analysis and Design of Astable, Monostable and Biastable Multivibrator. Differentiator circuit, Integrating circuit, Important applications of diodes, Clipping circuits and its applications, and Clamping circuits and basic idea of positive and negative Clamper.	9

Total Number of Hours=36 Hrs

Text/Reference Books:

1. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition, Pearson,2014.
2. Donald Neamen , Dhrubes Biswas "Semiconductor Physics and Devices" McGraw-Hill Education.
3. S. M. Sze and K. N. Kwok, Physics of Semiconductor Devices, 3rd edition, John Wiley&Sons, 2006.
4. C.T. Sah, Fundamentals of solid state electronics, World Scientific Publishing Co Inc,1991.
5. Y. Tsividis and M. Colin, Operation and Modeling of the MOS Transistor. Oxford Univ.Press, 2011.
6. A.K. Maini, N. Maini, All-in-One Electronics Simplified, Khanna Book Publishing, NewDelhi, 2021.
7. A.K. Maini, Analog Electronics, Khanna Book Publishing, New Delhi, 2022.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand and apply the principles of semiconductor Physics, diodes and biasing to electronic devices.
2. Understand and utilize the different configuration of transistor for the analysis of Hybrid parameter
3. Appreciate different semiconductor devices for different applications.
4. Understand and utilize the concept of semiconductor devices for solid state switching circuits.

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ECEPC-312 Digital System Design							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To understand the fundamentals of number systems and Boolean Algebra.*
- *To understand the concepts of MSI Devices and Applications.*
- *To understand the concepts of Combinational Logic Design, Programmemable Logic Devices.*
- *To conceptualize the working of Sequential Circuits, Synchronous Sequential Circuits.*
- *To gain the knowledge in VLSI Design flow.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Number system and codes:** Review of Boolean Algebra, Binary arithmetic (Addition, Subtraction, Multiplication and Division), Floating point numbers. BCD codes, 8421 code, Excess-3 code, Gray code, Error detection and correction: Parity code, Hamming code. **Logical Simplification**: De Morgan"s Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables. The tabulation method, Determination of prime implicants, Selection of essential prime implicants. Quine Mccluskey method.	9
II	**Combinational Logic Design:** MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU . **Logic families:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmemable logic devices like FPGA, Logic implementation using Programmemable Devices.	9

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III	**Sequential Logic Design:** Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.	**9**
IV	**VLSI Design flow: Design entry:** Schematic, FSM & HDL, different modelling styles in VHDL, Data types and objects, Dataflow, Behavioural and Structural Modelling, Synthesis and Simulation VHDL constructs and codes for combinationaland sequential circuits.	**9**

Total Number of Hours=36 Hrs

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill.
2. R. Anand, Digital System Design Using VHDL, Khanna Book Publishing Company.
3. R. Anand, Digital Electronics, Khanna Book Publishing Company.
4. Douglas Perry, "VHDL", Tata McGraw Hill.
5. Gothman, "Digital Electronics-An introduction to theory and practice", Pearson Education
6. Douglas-Hall, "Digital Circuits and Systems", Tata McGraw Hill
7. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the basic logic operations and combinational logic elements.
2. Design and analyze combinational circuits.
3. Design and analyze synchronous sequential logic circuits.
4. Use HDL and appropriate EDA tool for digital logic design and simulation.

ECEPC-313 Signal and System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To introduce the concepts of continuous time and discrete time signals and systems including their classification and properties.*
- *To comprehend and analyze the frequency domain representation of continuous timesignals.*
- *To learn and investigate the different types of representing continuous time LTI systemsand their properties.*
- *To comprehend and analyze the frequency domain representation of discrete time signals.*
- *To learn and investigate the different types of representing discrete time LTI systems andtheir properties*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Representation and Classification of Signals and Systems:** An introduction to signals and systems- Signals and systems as seen in everyday life, Representation ofsignals – Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous anddiscrete time signals, Basic Operation on the signals- Formalizing systems- system properties: linearity: additivity and homogeneity, invariance, periodicity, causality, stability.	12
II	**Fourier series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. **Fourier Transform:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function,	12

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III	**LTI systems: Response of LTI systems**: Convolution sum, convolution integral and their evaluation; Causality and stability considerations. **Continuous Time System Analysis:** Continuous Time LTI systems -Laplace Transform-Region of Convergence-Properties Analysis and characterization of LTI systems using the Laplace Transform.	**12**
IV	**Discrete Time System Analysis:** Discrete Time LTI systems, Z- Transformation: R.O.C of Z transform; Properties, Analysis and characterization of LTI systems usingthe Z Transform, Different methods of finding Inverse Z-Transformation. **Signal sampling:** The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasingand its effects. Relation between continuous and discrete time systems.	**12**

Total Number of Hours=36+12 =48 Hrs

Text/Reference Books:

1. R. Anand, Signals and Systems, Khanna Publishing House, 2019.
2. A.V. Oppenheim, A.S. Willsky and I.T. Young,"Signals and Systems", Prentice Hall,1983.
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
4. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
5. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
6. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
7. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia)Private Limited, c1998

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Identify the sources of signals, and systems in real life.
2. Characterize different types of signals and systems.
3. Represent continuous-time and discrete-time systems in different mathematical forms.
4. Analyze system behaviour using time and frequency domain techniques.

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ECEPC-314 Network Theory						
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:
Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To analyze the given electrical network using Kirchoff's laws.*
- *To analyze the two-port networks, passive filters.*
- *To introduce the basic knowledge of Laplace transform and to analyze the network usingsuitable technique.*
- *To understand the use of network topology in circuit solving.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Node and Mesh Analysis:** Kirchhoff's laws, Node and mesh analysis, Matrix approach of network containing voltage and current sources, source transformation, three phase and power calculations. **Network theorem:** Superposition, Thevenin's, Norton's, Maximum power Transfer, Reciprocity, and Tallegen's theorem as applied to AC. circuits.	12
II	**Two port networks:** Two port network, Classification of parameters: Open circuit and Short circuit parameters, Transmission and inverse transmission parameters, Hybrid and inverse hybrid parameters, Interconnection of two port networks: Series, Parallel, Cascade and series-parallel connection, Driving points and transfer functions poles and zeros of immittance function and their properties. Passive filters Introduction to Low pass, High pass, Band pass, Band reject filters.	12
III	**Laplace transform and RLC circuits:** Definition of Laplace transform and its inverse, Basic function of Laplace transform, Partial fraction, Transient response of RC, RL, and RLC networks with initial conditions (series combinations only) for DC and sinusoidal excitations.	12
IV	**Network Topology**: Graph of a network, Trees, Links, Twigs, Incidence and reduced incidence matrices, Fundamental Cut-set matrix and Tie-set matrix, Relationbetween various matrices, Network equilibrium equations: using KVL and KCL, Duality and dual networks.	12

Total Number of Hours=36 + 12 = 48 Hrs

Text/Reference Books:

1. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000.
2. A William Hayt, "Engineering Circuit Analysis" McGraw Hill Science Engineering, 8th Edition,2013.
3. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi,1994.
4. Ashfaq Husain, Networks and Systems, Khanna Book Publishing, 2021.
5. Networks and Systems, D.Roy Choudhury, New Age International.
6. Circuit Theory -Analysis and synthesis, A. Charkrabarti, Dhanpat Rai & co.
7. Fundamentals of Electric circuits, Charles K Alexander, Matthew N O Sadiku, TMH

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze the circuit using Kirchhoff's law and Network simplification theorems
2. Infer and evaluate Transient response and Steady state response of a network
3. Analyze electrical networks in the Laplace domain and understand concept of network functions and stability.
4. Compute the parameters of a two-port network.

HS-311 Engineering Economics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Learning Objectives:

- Understand the basic definitions, nature, scope, and significance of economics.
- Learn about the elasticity of demand, its types, methods of measurement, and its importance in economic analysis.
- Examine price determination under different market structures, including perfect competition, monopoly, monopolistic competition, and oligopoly.
- Explore the meaning, types, theories, causes, effects, and control measures of inflation.

Unit-I
Introduction: Definition, Nature, Scope, Importance and significance of Economics, Distinction between Microeconomics and Macroeconomics. Concept of Utility and Its Types.**Demand and Supply:** Meaning, Demand Function, Law of Demand. Elasticity of Demand, Types, Measurement and importance. Demand Forecasting and its techniques. Concept of Supply, Law of supply.
Unit-II
Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions. **Cost and Revenue:** Concept of Cost, Short run and Lung-run Cost Curves, Relationships among various costs, Break-even Analysis. Revenue: Concept and its types.
Unit-III
Market Structure: Price Determination under Different Market Structure i.e. Perfect Competition, Monopoly, Monopolistic Competition Oligopoly. **Reserve Bank of India:** Nature, Organisation Structure, Objectives, Function of RBI.**Monetary Policy and Fiscal Policy:** Meaning, Objectives and Its tools and Techniques of Monetary and Fiscal Policy.
Unit-IV
National Income: Definition of National Income and its Aggregates, Methods of Calculating National Income. **Inflation:** Meaning, Types, Theories, Causes, Effects and Control. **Business Cycle** – Meaning- Phases of business cycle.

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Course Learning Outcomes (CLOs):

After the completion of the course, the student will be able to:

- Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply and demand curves on equilibrium price and output.
- Determine the roles that prices and markets play in organizing and directing economic activity
- Calculate and graph the short-run and long-run costs of production, supply and demand elasticities.
- Describe governmental efforts to address market failure such as monopoly power, externalities, and public goods.
- Examine and interpret a nation's economic performance indicators such as economic growth, unemployment and inflation from a macroeconomic perspective.
- Articulate the mechanics and institutions of international trade and their impact on the macro economy.

Textbooks:

1. Steven A. Greenlaw, David Shapiro, **"Principles of Economics"**,2nd Edition, Rice UniversityOpenStax, 2020.ISBN-13: 978-1947172371.
2. Managerial Economics, 8/e, D N Dwivedi, Vikas Publishing.

Reference Books:

1. N. Gregory Mankiw, **"Principles of Economics"**,8th Edition, Cengage Learning, 2016.ISBN-13:978-0357038314.
2. Niall Kishtainy, **"The Economics Book: Big Ideas Simply Explained"**,1st Edition, DK Publishers, 2012.ISBN-13:978-0756698270.
3. Yves Hilpisch, **"Python for Finance: Mastering Data-Driven Finance"**, 2nd Edition, O'Reilly Media, 2018 ISBN-13:978-1492024330.

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ECEPC-311P Electronic Devices Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *To Understanding the characteristics of semiconductor devices*
- *Implementation of circuits experimentally based on the knowledge gained in semiconductor devices*

Laboratory Exercises: (Perform any Ten exercises)

1. To study the V-I characteristics of different types of semiconductor diodes.
2. To study the V-I characteristics of zener diode: determination of breakdown voltage.
3. To study CE transistor as an amplifier and verify its various parameters.
4. To study the different biasing circuits.
5. To study the CE transistor configuration: determination of H parameters.
6. To study the characteristics of JFET, determination of output and transfer characteristics.
7. To study the characteristics of MOSFET, determination of output and transfer characteristics.
8. To study the characteristics of UJT, SCR and TRIAC.
9. To study the input and output waveform of clipping circuit using diodes.
10. To study the input and output waveform of clamping circuits using diodes.
11. To study the VI characteristics of LED.
12. Develop a prototype consisting of basic devices covered in this laboratory course.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Understanding the characteristics of semiconductor devices.
2. Implementation of circuits experimentally based on the knowledge gained in semiconductor devices.
3. Gaining practical knowledge of electronic devices.

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ECEPC-312P Digital System Design Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *To represent logical functions in canonical and standard forms.*
- *To design and analyse the combinational logic circuits.*
- *To design and analyse the sequential logic circuits.*
- *To implement combinational and sequential logic circuits using HDL.*

Laboratory Exercises:

1. Design and implementation of the following Code convertors
   a. BCD to excess-3 code and vice versa b. Binary to gray code and vice-versa
2. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC7483
3. Magnitude comparator
   a. Studyof 4-bit magnitude comparator IC
   b. Realization of 8-bit magnitude comparator using 4-bit magnitude comparator ICs.
4. Multiplexers and Encoders
   a. Realization of 16×1 multiplexer using 8×1 multiplexer ICs
   b. Realization of a combinational circuit using multiplexer
   c. Construction and study of a simple Priority Encoder
5. Decoders and Demultiplexers
   a. Realization of 4 to 16 line decoder using 3 to 8 line decoder ICs
   b. Realization of a combinational circuit using a decoder IC
6. Shift register
   a. Construction of ring counter and Johnson counter using a shift register IC and study of theirtiming diagrams b. Designing a PN Sequence Generator using a shift register IC
7. Ripple Counters and their timing diagrams
   a. 3-bit binary up/down counter
   b. A modulo-N-counter (where n is the no. of FFs used to construct the counter)
   c. BCD counter using mod-10 counter ICs
8. Design and implementation of Synchronous Counters and study of their timing diagrams
   a. Binary counter b. Non-sequential binary counter c. 3-bit binary up/down counter
9. Study of a Memory IC
   a. READ and WRITE operations involving memory chips b. Expansion of memory size
10. Simulate the following circuits using VHDL/Verilog:
    a. Ex-OR Gate b.Full Adder c. Multiplexer d. Binary Up-Counter e. Binary Up-down Counter f. Shift Register

Course Outcome:

At the end of the course the student should be able to

i. Understand the number systems and IC characteristics
ii. Understand the Boolean algebra and its properties
iii. Design and analyse the combinational logic circuits
iv. Get grip on HDL syntax.

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ECEPC-313P Signal and System Lab using Matlab/Python							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

The laboratory practicals for Signal and Systems aim to provide hands-on experience in analyzing signals, systems, and their properties using computational tools like Matlab or Python. Students will learn to simulate, visualize, and interpret various signal processing techniques, system responses, and characteristics.

Course Outline and Practice:

1. Introduction to Python/Matlab for Signal Processing
    a. Familiarization with the Python/Matlab environment for signal processing.
    b. Basics of handling signals: generation, manipulation, and visualization.
2. Time-Domain Analysis
    a. Simulating basic signals: sinusoidal, step, ramp, impulse.
    b. Convolution and correlation operations.
    c. Effects of linear time-invariant (LTI) systems on signals.
3. Frequency-Domain Analysis
    a. Fourier series and Fourier transform.
    b. Power spectral density and energy spectral density.
    c. Filtering techniques: low-pass, high-pass, band-pass filters.
4. Sampling and Reconstruction
    a. Sampling theorem and aliasing.
    b. Discrete-time signals and systems.
    c. Digital filter design and implementation.
5. System Response Analysis
    a. Impulse response and step response of systems.
    b. Transfer function analysis.
    c. Stability and causality of systems.

Laboratory Exercises:

1. **Exercise 1: Signal Generation and Visualization**
    a. Generate and plot basic signals using Python/Matlab.
    b. Visualize and compare different signal properties (amplitude, frequency).
2. **Exercise 2: Time-Domain Analysis**
    a. Perform convolution and correlation operations on signals.
    b. Analyze the effect of LTI systems on input signals.
3. **Exercise 3: Frequency-Domain Analysis**
    a. Compute and plot Fourier series and Fourier transform of signals.
    b. Design and implement digital filters for signal conditioning.

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4. **Exercise 4: Sampling and Reconstruction**
    a. Verify sampling theorem through practical examples.
    b. Implement interpolation and decimation techniques.
5. **Exercise 5: System Response Analysis**
    a. Calculate and plot impulse and step responses of systems.
    b. Analyze system stability using Python/Matlab tools.

6. Make a Project on a selected topic related to signal processing, demonstrating comprehensive understanding and application of Python/Matlab tools.

Assessment:

(i) Lab reports documenting the results, analysis, and interpretation of each exercise.
(ii) Quizzes or short tests to assess understanding of theoretical concepts and practical applications.
(iii) Final project on a selected topic related to signal processing, demonstrating comprehensive understanding and application of Python/Matlab tools.

Resources:

(i) Textbooks and references on signal processing theory and applications.
(ii) Online tutorials and documentation for Python/Matlab.
(iii) Access to simulation software and computing resources for practical exercises.

Course Outcome:

At the end of the course the student should be able to

1. Demonstrate proficiency in analyzing signals using Python/Matlab, including time-domain and frequency-domain analysis techniques such as Fourier transforms, filtering, and spectral analysis.
2. Understand the characteristics of linear time-invariant (LTI) systems, including their impulse and step responses, transfer functions, stability criteria, and the effects of systems on input signals.
3. Apply digital signal processing techniques such as sampling, reconstruction, and digital filtering to analyze and manipulate signals effectively.
4. Develop hands-on experience in simulating and analyzing signal processing systems, enhancing their problem-solving skills in engineering and scientific contexts through practical exercises and projects.

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SEMESTER-IV

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ECEPC-411 Analog Circuits							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To analyze different amplifier models.*
- *To pioneer the high frequency transistor models and feedback topologies*
- *To understand the concepts of oscillators*
- *To conceptualize the working of OP-AMP and its applications*
- *To gain the knowledge of Digital-to-analog converters*

UNIT	CONTENT	No. of Hrs.
I	**Low Frequency of Transistor Amplifiers:** Single stage amplifier, General cascadedsystem, EC coupled amplifier and its frequency response, merits and demerits,Transformer coupled amplifier, Darlington pair amplifier, Effect of frequency response on multistage amplifier. **High Frequency Response of Transistor Amplifiers:** High frequency model for the common emitter amplifier, Approximate CE high frequency model with a resistive load, CE short circuit current gain, High frequency current gain with a resistive load.	9
II	**Transistor Audio Power Amplifiers:** Difference between Voltage amplifier and Power amplifier, Analysis and design of Class A, B and AB amplifier; Single ended power amplifier, Push Pull Amplifiers, Merits and Demerits, Distortion calculation. **Tuned Amplifier:** General behavior of tuned amplifiers, Advantages and disadvantages of tuned amplifier, Single tuned amplifier, Frequency response of single tuned amplifier, Doubled tuned amplifier and its frequency response.	9
III	**Feedback Amplifier:** Introduction, Classification of feedback, Characteristics of negative feedback, Feedback topologies: Voltage series, Voltage shunt, current series and Current shunt feedback. **Oscillators:** Review of basic concept, Barkhausen criterion, RC oscillators (phase shift, wein bridge), LC oscillators (Hartley, Colpitt).	9

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IV	**OP-AMP Applications:** Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt triggerand its applications. Active filters: Low pass, high pass, band pass and band stop. **Converters:** Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder,resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope,successive approximation, flash etc.	9

Total Number of Hours=36 Hrs

Text/Reference Books:

1. A.V.N. Tilak, Design of Analog Circuits, Khanna Publishing House, 2022.
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, Edition IV.
5. Paul R.Gray & Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley,3rd Edition.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand different circuit configuration of different devices for various applications.
2. Design circuits by using appropriate device models
3. Design various analog circuits required in electronic systems.
4. Design mixed circuits such as ADC and DACs

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ECEPC-412 Microcontrollers							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	0	0	3	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To understand the Architecture of 8085, 8086 and its assembly language Programming*
- *To study the interfacing of peripheral devices*
- *To understand the features of 8-bit Microcontroller and system design*
- *To explore the features of 16 bit and higher Microprocessors' architectures*
- *To Design and Implement Microcontroller based Systems.*

UNIT	CONTENT	No. of Hrs.
I	**Microprocessor 8085:** Evolution of Microprocessor, The 8085 MPU- features,architecture and Pin configuration, 8085 machine cycle and timing diagrams, Addressing modes, Interrupts. **Instruction set and Programming concepts:** Data transfer operations, Arithmetic operations, Logic operations, Branch operation, and Machine control instruction. Flow chart symbols, Development of assembly language programmes.	9
II	**16-bit Microprocessors (8086):** Architecture, Pin Description, Physical address, segmentation, memory organization, Addressing modes. Peripheral Devices: 8237 DMA Controller, 8255 programmemable peripheral interface, 8253/8254 programmemable timer/counter, 8259 programmemable interrupt controller, 8251 USART and RS232C. **Advanced coprocessor Architectures**- 286, 486, Pentium.	9
III	**Microcontroller 8051 - Building Blocks:** Microprocessor vs microcontroller; RISC vs CISC architectures, 8051 Architecture, Internal memory organization, Internal RAM structure, Processor status word, Types of Special Function Registers and theiruses in 8051.architecture, pin configuration, flag-bits and PSW register, input-output ports, register banks and stack. **Instruction set of 8051:** Addressing modes, Data transfer instructions, Arithmetic	9

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	instructions, Logic instructions, branching instructions and Bit manipulation instructions.	
IV	**Programming concept of 8051:** Introduction to 8051 assembly programming, Jump, loop and call instructions Programming, Programming 8051 Timers, Interrupts Programming, Serial communication Programming. **Advance Microcontroller**: Introduction features and block diagram of PIC and ARM microcontroller.	9

Total Number of Hours = 36Hrs

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardwareand software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J.Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
5. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and SystemDesign 8085, 8086, 8051, 8096", PHI Learning Pvt. Ltd., Second Edition, 2013.
6.A.K. Ray and K.M.Burchandi, and A.K.Ray, "Advanced Microprocessor and Peripherals",McGraw Hill International Edition, Third Edition, 2017.
7.John B. Peatman, "Design with PIC Microcontrollers", Pearson Education, 2013.
8.Andrew N. Sloss Dominic Symes and Chris Wright, "ARM System Developer"s Guide Designing and Optimizing System Software", Morgan Kaughmann/Elsevier Publishers, 2006.
9.Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi, and Janice Mazidi, "ARM Assembly Language Programming & Architecture", II Edition, 2016.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the architecture of microprocessors and microcontrollers
2. Develop programmes for various microcontrollers.
3. Interface various peripherals with microcontrollers and programmes it for various systems
4. Design and implement real-life engineering applications

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ECEPC-413 Analog Communication							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To understand the various amplitude modulation and demodulation techniques & systems.*
- *To understand the complex low pass representations, SSB and VSB modulations.*
- *To understand the angle modulation and demodulation techniques.*
- *To understand the functions of AM and FM transmitters and receivers.*
- *To understand the effect of noise on the performance of AM and FM receivers and the principles of PAM, PWM, and PPM, TDM, and FDM techniques*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Modulation Techniques:** Various Frequency Bands Used for Communication, Types of Communication and Need of Modulation. Introduction to AM, FM, PM, Frequency Spectrum of AM Waves, Representation of AM, Power Relation in AM Waves, Need and Description of SSB, Suppression of Carrier, Suppression of Unwanted Side- bands, Independent Sideband System, Vestigial Sideband System, Mathematical Representation of FM, Frequency Spectrum of AM Waves, Phase Modulation, Comparison Between Analog and Digital Modulation, Wideband and Narrow Band FM.	12
II	**AM Transmitters and Receivers AM Transmitters:** Generation of AM, Low Level and High Level Modulation, AM Transmitter Block Diagram, Collector Class C Modulator, Base Modulator, Transistor Vander Bill Modulator, DSB S/C Modulator. AM Receiver: Tuned Radio Frequency (TRF) Receiver. Super Heterodyne Receiver, RF Section and Characteristics, Mixers, Frequency Changing and Tracking, IF Rejection and IF Amplifiers. Detection and Automatic Gain Control (AGC), AM Receiver Characteristics.	12

III	**FM Transmitters and Receivers:** FM Transmitters, Basic Requirements and Generation of FM, FM Modulation Methods: Direct Methods, Variable Capacitor Modulator, Varactor Diode Modulator, FET Reactance Modulator, Transistor Reactance Modulator, Pre-emphasis, Direct FM Modulator, AFC in Reactance Modulator, Disadvantages of Direct Method, Indirect Modulators, RC Phase Shift Modulators, Armstrong FM Systems. FM Receivers: Limiters, Single and Double- Tuned Demodulators, Balanced Slope Detector, Foster-Seeley or Phase Discriminator, De-emphasis, Ratio Detector, Block Diagram of FM Receivers, RF Amplifiers, FM Receiver Characteristics.	12
IV	**SSB Transmitters and Receivers:** Generator of SSB, Balanced Modulator Circuit, Filter Method, Phase Shift Method, Third Method, Phase Cancellation Method, Demodulation of SSB, Product Demodulator, Diode Detection Technique of SSB. **Pulse Modulation Techniques:** Pulse Amplitude Modulation and Demodulation, Pulse Width Modulation and Demodulation, Pulse Position Modulation and Demodulation, Sampling Theorem, Time Division Multiplexing, Frequency DivisionMultiplexing.	12

Total Number of Hours = 36 + 12 = 48 Hrs

Text/Reference Books:

1. B.P.Lathi,Zhi Ding "Modern Digital and Analog Communication", Oxford, 4th Edition,2011
2. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Taub H. and Schilling D.L., "Principles of Communication Systems",Tata McGraw Hill, 2001.
5. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.
6. R. Anand, Communication Systems, Khanna Book Publishing Company, 2011.

Course Outcomes:

At the end of this course, the students should be able to

1. Differentiate AM and FM transmission.
2. To analyze various methods of base band /band pass analog transmission and detection.
3. Gain the knowledge of components of analog communication system
4. Compare bandpass digital modulation techniques for bit error rate, bandwidth and power requirements.

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ECEPC-414 Electromagnetic Waves							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- *To impart knowledge on the basics of transmission lines*
- *To learn basic electromagnetic equations and make students to have depth understanding of EM waves and the propagation of EM waves.*
- *To introduce waveguides and radiation*
- *To learn antenna characteristics, linear antennas and their arrays*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Transmission Lines:** Equations of Voltage and Current on TX line, Propagation constant, Characteristic impedance and reflection coefficient, Impedance Transformation, Loss-less and Low Loss Transmission line and VSWR, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines, Impedance Matching, Lossy transmission line, Problems on Transmission line, Types of transmission line.	12
II	**Electromagnetic Wave Equations:** Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. **Uniform Plane Wave:** Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Pioncere's Sphere, Wave propagation in conducting medium, Wave propagation and phase velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.	12

III	**Plane Waves:** Plane Waves at a Media Interface- Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction at media interface, Total internal reflection, Polarization at media interface, Reflection from a conducting boundary. **Waveguides:** Waveguides- Parallel plane waveguide, Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization and Attenuation in waveguide.	**12**
IV	**Radiation:** Solution for magnetic vector potential function, Radiation from the Hertzdipole, Power radiated by hertz, dipole, thin linear antenna, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna, Fourier transform relation between current and radiation pattern.	**12**

Total Number of Hours=36+12=48 Hrs

Text/Reference Books:

1. R.K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill India, 2005.
2. E.C. Jordan & K.G. Balmain, "Electromagnetic waves & Radiating Systems", Prentice Hall, India, Second Edition, 2007.
3. R.L. Yadav, "Electromagnetic Fields and Waves", Khanna Book Publishing, 2021
4. Narayana Rao, "N: Engineering Electromagnetics", Prentice Hall, India, Third Edition, 1997.
5. William H. Hayt, "Engineeering Electromagnetics", McGraw Hill, Fifth Edition, 2008.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Appreciate the importance of transmission lines and analyze transmission line problems like impedance transformation and matching using analytical and graphical methods.
2. Solve Maxwell"s equations to understand propagation of electromagnetic waves in unbound medium and across media interfaces.
3. Analyze electromagnetic wave propagation in rectangular metallic waveguides and resonators.
4. Understand antenna characteristics, and design linear antennas and their arrays.

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CSPC- 414 Introduction to Artificial Intelligence							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questionsin all, i.e one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objective:

- ***Understand foundational concepts****: Introduce students to the fundamental theories, algorithms, and methodologies underlying artificial intelligence.*
- ***Develop practical skills****: Equip students with hands-on experience in implementing AI techniques to solve real-world problems.*
- ***Critically analyze AI applications****: Enable students to evaluate the ethical, social, and economic implications of AI technologies.*
- ***Prepare for advanced studies and careers****: Provide a solid foundation for further studies inAI and prepare students for careers in AI-related fields.*

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Introduction to artificial intelligence, background, possible approachesin AI, Turing test and rational agent approaches, introduction to intelligent agents, their structure, behaviour and environment, applications, Future of AI. **Problem Solving and Searching Techniques**: Problem characteristics, production systems, breadth first search, depth first search, heuristics search techniques, best firstsearch, A*algorithm, hill climbing, AND/OR graph AO*, constraint satisfaction problem, means-end analysis.	12
II	**Game Playing:** introduction to game playing, min max and alpha beta pruning. **Knowledge Representation:** Knowledge Representation: Representation, introduction to first order predicate logic, well-formed formulas, quantifiers, rule-based system, Syntax and Semantics of First-Order logic, knowledge engineering infirst-order Logic. Inference in first order logic: resolution principle, unification, forward reasoning:conflict resolution, backward reasoning, structured knowledge representation.	12

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III	**Introduction to Neural Network:** Introduction, importance of neural network, Types of neural network, Hop field network, single and multi layer networks, perceptions, types of learning in neural networks. **Introduction to genetic algorithm:** The genetic algorithm, genetic operators, working of genetic algorithm, problem with genetic algorithm.	**12**
IV	**Expert System:** Expert Systems: introduction, skills/knowledge, characteristics of expert system, applications and future scope, Expert system tools – MYCIN –EMYCIN **Natural language processing:** Introduction, language parsing, syntactic and semantic analysis, top down and bottom-up parsing, chart parsing, knowledge representation languages, ELIZA.	**12**

Total Number of Hours=36 +12 =48Hrs

Text/Reference Books:

1. Russell and Norvig, —Artificial Intelligence- A Modern Approach‖, Pearson Prentice Hall.
2. D W Patterson, —Artificial Intelligence and Expert Systems‖, Prentice Hall of India.
3. B.Vegnanarayana, —Artificial neural networks‖, Prentice Halll of India P Ltd
4. Elaine Rich, Kevin Knight, —Shivashankar B. Nair, Artificial Intelligence‖, Tata McGraw Hill.
5. Nils J Nilsson, —Artificial Intelligence A New Synthesis‖, Morgan Kaufmann

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Demonstrate fundamental understanding of Artificial Intelligence (AI) and its foundation
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning
3. Demonstrate proficiency in applying scientific method to models of machine learning
4. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications

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IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

Question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B,C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate will attempt five questions in all, i.e., one question each from sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV respectively and section-E will cover whole syllabus.

Course Objectives:

- *To equip the students with the knowledge and understanding related to Indian knowledgesystems,origin, evolution and the approaches used in ancient and modern times.*
- *To promote the youths to do research in the various fields of Bhāratīya knowledge system.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Bhāratīya Civilization and Development of Knowledge System.** Genesis of the Bharatbhumi and Civilization ,Discovery of the Saraswatī River, The Saraswatī-Sindhu civilization, Traditional knowledge system, The ancient education system, Brief introduction of the Takṣaśilā University, The Nālandā University,Knowledge export from Bharata	12
II	**Art, Literature and Scholars** Natraja- A masterpiEEE of Bhartiya Art, Introduction to Vedas and Vedic Literature, Life and works of Agastya,Vālmīki, Patañjali, Vedvyāsa, Loapmudra,Maitreyi,Gārgī, Caraka, Suśruta, Kaṇāda, Kauṭīlya, Pāṇini, Āryabhaṭa, Varahmihira,Bhāskarācārya	10
III	**Engineering Science and Technology** Engineering, science and technology in the Vedic Age, Post-Vedic period,History of Mathematics in Bharata, Concepts of Zero,History and Culture of Astronomy in India,Kerala School of Astronomy and Mathematics.	16
IV	**Cultural Heritage and Indian Traditional Practices** Temple architecture in ancient India, Fairs and festivals, Yoga ,Āyurveda,Integrated apporach to healthcare, Agriculture in Ancient India, Approaches and strategies to the protection and conservation of environment.	10

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Text/Reference Books:

1. Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
2. Pradeep Kohle et. Al. Pride of India- A Glimpse of India's Scientific Heritage edited by SanskritBharati, 2006.
3. Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
4. Sibaji Raha, et al, History of Science in India Volume-1, Part-I, Part-II, Volume VIII, NationalAcademy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

Course Outcomes (COs):

After the completion of the course, the student will be able to:

1. Explore the genesis of Bharatbhumi, Saraswati River discovery, and Saraswati-Sindhu civilization, emphasizing traditional knowledge systems and ancient educational structures.
2. Analyze masterpiEEEs like Natraja, delve into Vedas, and study the lives and works of prominent figures such as Agastya, Valmiki, Patanjali, and Aryabhatta, highlighting their contributions to Indianculture.
3. Study engineering and technology during the Vedic and post-Vedic ages, trace the history ofmathematics and astronomy in India, and explore the contributions of scholars from institutions like Takshashila and Nalanda.
4. Examine temple architecture, festivals, yoga, Ayurveda, and ancient agricultural practices, emphasizing integrated healthcare approaches and environmental conservation strategies derived from Indian traditions.

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ECEPC-411P Analog Circuits Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *Knowledge to study and design various amplifiers*
- *Understanding the characteristics of OP-AMP and its applications*
- *Analyzing and comparing the operations of different Oscillators*
- *Implementation of circuits experimentally based on the knowledge gained in Digital-to-analog converters*

List of Experiments: (Perform any Ten experiments)

1. To study the two stage RC coupled transistor amplifier.
2. To study Class-B push pull amplifier at audio frequency.
3. To find the Efficiency of Class-A or Class AB Amplifier.
4. To plot frequency response of Single Tuned Amplifier.
5. To study the frequency response of BJT amplifier with and without feedback.
6. To study the application of Op amp IC741 as: Inverting and Non-inverting amplifier.
7. To study the op amp performance as differentiator and integrator for various time constants.
8. To study Schmitt trigger using op amp 741.
9. To design and study the working of
   a. Astable Multivibrator b. Monostable Multivibrator using IC 741.
10. To study operation of op-amp as V to I and I to V converters.
11. Design of Oscillators for the given Specifications: RC Phase shift Oscillators b. Colpitts Oscillator c.Hartley Oscillator
12. To study the performance of R-2R and ladder type DAC circuit.
13. To study the performance of successive approximation type ADC.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Understand and comparing the operations of different amplifiers with their characteristics.
2. Knowledge to design and test the different types of oscillators for the generation of required frequency.
3. Knowledge to design and test the different types of converters.

ECEPC-412P Microcontrollers Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *To Understanding the working of microcontroller*
- *Knowledge to programme, debug and analyze codes*
- *Acquiring and applying microcontroller Programming and interfacing skills*

List of Experiments: (Perform any Ten experiments)

1. Write a programme using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction oftwo Numbers.
2. Write a programme using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a programme to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a programme to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmemable interval timer to 8085 and verify the operation of 8253 in sixdifferent modes.
9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port.
11. Write a programme of Flashing LED connected to port 1 of the 8051 Micro Controller
12. Write a programme to generate 10 kHz square wave using 8051.
13. Write a programme to show the use of INT0 and INT1 of 8051.
14. Write a programme for temperature & to display on intelligent LCD display.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Interface Microprocessor with different kinds of Peripherals.
2. Identifyand understand the function of 8051 microcontroller & its Peripherals.
3. Understand, Design and execute programmes based on microcontroller.
4. Design and Implement Microcontroller based Systems.

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ECEPC-413P Analog Communication Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *The objective of the Analog Communication course is to provide students with a thorough understanding of the principles, techniques, and practical applications of analog communication systems.*
- *Through theoretical study, laboratory exercises, and projects, students will develop the necessary skills to analyze, design, and implement various modulation techniques used in analog communication.*

List of Experiments: (Perform any Ten experiments from Hardware and Simulation section)

Part - A: Hardware

1. Study of Amplitude Modulation- Mod & Demod.
2. Study of AM- DSB SC- Mod & Demod.
3. Perform Spectrum Analysis Of Modulated Signal Using Spectrum Analyzer.
4. Study of Diode Detector.
5. Study of Pre- Emphasis &De- Emphasis circuit.
6. Study of Frequency Modulation- Mod. & Demod.
7. Study of Pulse Amplitude Modulation – Mod. & Demod.
8. Study of Pulse Width Modulation – Mod. & Demod.
9. Study of Pulse Position Modulation – Mod. & Demod.
10. Study of Phase Locked Loop circuit.
11. Plot Radio Receiver Characteristics.
12. Study On Radio Receiver/TV Receiver Demo Kits.

Part – B: Simulation (Matlab/Simulink/Labview)

1. Study of Amplitude Modulation- Mod & Demod.
2. Study of AM- DSB SC- Mod & Demod.
3. Perform Spectrum Analysis Of Modulated Signal Using Spectrum Analyzer.
4. Study of Diode Detector.
5. Study of Pre- Emphasis &De- Emphasis circuit.
6. Study of Frequency Modulation- Mod. & Demod.
7. Study of Pulse Amplitude Modulation – Mod. & Demod.
8. Study of Pulse Width Modulation – Mod. & Demod.
9. Study of Pulse Position Modulation – Mod. & Demod.
10. Study of Phase Locked Loop circuit.
11. Sampling Theorem

Part-C Add On Experiments

(i) Frequency Response Of Band Pass Filter.
(ii) Frequency Response Of Low Pass Filter.
(iii) Harmonic Generator.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Demonstrate a deep understanding of the fundamental principles underlying analog communication systems, including modulation techniques (AM, FM), signal transmission, and reception.
2. Be proficient in designing, simulating, and analyzing various analog modulation techniques such as AM (DSB-SC, SSB, VSB) and FM, including understanding modulation index variations and their impact on signal quality.
3. Analyse and evaluate signal quality parameters such as signal-to-noise ratio (SNR), bandwidth efficiency, and the effects of noise and distortion on analog communication signals.
4. Gain practical skills in designing and implementing analog communication systems, includingreceiver design considerations (sensitivity, selectivity, fidelity), channel capacity analysis, and optimization of system performance.

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CSPC-414P AI Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	2	1	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours
				Minimum Marks: 12	Minimum Marks: 08	20	

Course Objective:

- *The objective of the course is to learn how to clean and prepare the data, apply AI algorithms, and interpret the results to influence decision-making. Integration with existing knowledge management systems: In this section, participants will learn how to integrate AI applications into their existing knowledge management systems.*

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. Theadditional experiments may be performed by the respective institution depending on the infrastructure available.

List of experiments:

1. Write a program to implement breadth first search algorithm.
2. Write a program to implement depth first search algorithm.
3. Write a program to implement the Hill Climbing algorithm.
4. Write a program to build and display Neural network using Tenser flow Keres.
5. Write a program to implement Genetic algorithm.
6. Study of expert system tools and its applications.
7. Write a program to implement Traveling salesman problem.
8. Write a program to implement four queen problem.
9. Write a program to solve monkey banana problem.
10. Write a program to implement Tower of Hanoi.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. To understand the basic concepts of Artificial Intelligence.
2. To apply various AI Search algorithms.
3. To understand the fundamentals of knowledge representation and theorem proving using AI tools.
4. Ability to apply knowledge representation and machine learning techniques to real life problems.

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ECEEE-414P Micro Project							
Teaching Scheme			Credit	Marks Distribution			
L	T	P		Internal Assessment	End Semester Examination	Total	Duration of End Semester Examination
0	0	2	1	Maximum Marks: 60	Maximum Marks: 40	100	3 Hours
				Minimum Marks: 24	Minimum Marks: 16	40	

Guidelines: The micro-project is a team activity having 3-4 students in a team. This is electronic circuit building and testing for developing real life small electronic applications. The micro-project may be a complete hardware or hardware with small Programming aspect. It should encompass electronics components, devices, analog or digital ICs, micro controller etc. Micro-Project should cater to a small system required in laboratory or real-life application. Based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Micro-project.

Course Outcomes:

At the end of the micro project, students will demonstrate the ability to:

1. Identify and define a problem statement from the requirements raised from literature survey /needanalysis
2. Build and Test electronic circuits/prototype for developing real life small electronic applications.
3. Work in teams; write comprehensive report and effective presentation of the project work.
4. Rapid prototyping which will lead them towards entrepreneurship.

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