HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.

Electronics and Communication Engineering (ECE)

3rd to 4th Semester

As per National Education Policy (NEP)-2020

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

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**

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	1	0	4	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 Field Theory	3	1	0	4	40	60	100
5	ES	*CSPC- 414	Artificial Intelligence in Engineering	3	0	0	3	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**
**** Exit Option to 2- Year UG Diploma**										
1	INT	ECE-415P	**Internship-I (Exit)**	**8 Weeks/ 2 Months**				30	20	50

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Note:

***Common Subject**

****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may exercise exit option after 2nd Year for which he/she will be awarded UG diploma provided they secure an additional 6 credits through summer internships/ apprenticeship for two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5thsem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years'Diploma if has cleared all the four semesters without any back log in accordance with fulfilment of above requirements

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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

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	1	0	4	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 Field Theory	3	1	0	4	40	60	100
5	ES	*CSPC- 414	Artificial Intelligence in Engineering	3	0	0	3	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**
**** Exit Option to 2- Year UG Diploma**										
1	INT	ECE-416P	**Internship-I (Exit)**	**8 Weeks/ 2 Months**				30	20	50

Note:

***Common Subject**

****Exit Option (as per NEP)**: These **6 credits** shall be counted only for those taking Exit Option for 2-year diploma.

- Direct entry students (not applicable for lateral entry students) may exercise exit option after 2nd Year for which he/she will be awarded UG diploma provided they secure an additional 6 credits through summer internships/ apprenticeship for two months/8 weeks after 4th Semester.
- The student concerned has to apply for UG diploma exit option at the time of filling up of end semester examination of 4th Semester (provided he has no back log up to 3rd semester). The evaluation of such candidates shall be done by the concerned department of Institution after successful completion of internship by the candidate.
- The course Internship-I will be completed by students during summer vacations after 4th semester under the supervision of faculty of department. The internship should, preferably, be focused on site EXPERMENTIAL LEARNING and CONTRIBUTION TO COMMUNITY for the benefit of local industry, government/private organization, entrepreneurs, craft and skilled people.
- The evaluation and viva voce of such candidates (who opted for UG Diploma) shall be done at the earliest possible, preferably within one month of running next semester, *i.e.*, 5th sem (and not with end semester exams of 5th semester).
- The student will be recommended for 2-Years'Diploma if has cleared all the four semesters without any back log in accordance with fulfillment of above requirements

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SEMESTER-IV

ECEPC- 411 Analog Circuits							
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	3Hours
				Minimum Marks:16	Minimum Marks: 24	40	

Instructions to the question papers setter:

The question paper for the 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 the whole syllabus.

Course Objective:

- *To analyze different amplifier models.*
- *To pioneer the high frequency transistor models and feed back 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*

COURSE-CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Low Frequency of Transistor Amplifiers:** Single stage amplifier, General cascaded system, EC coupled amplifier and its frequency response, merits and demerits, Transformer coupled amplifier, Darling ton pair amplifier, Effect of frequency response on multi stage 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, Voltages hunt, current series and Current shunt feedback. **Oscillators:** Review of basic concept, Bark hausen 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 trigger and its applications. Active filters: Lowpass, high pass, band pass and band stop. **Converters:** Digital-to-analog converters (DAC): Weighted resistor, R-2 R 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 PublishingHouse,2022.
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, Mc Graw Hill, 1992.
3. P. Horowitzand W.Hill, The Art of Electronics, 2nd edition, Cambridge University Press,1989.
4. A.S. SedraandK.C.Smith,MicroelectronicCircuits,Saunder'sCollegePublishing,EditionIV.
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	3Hours
				Minimum Marks:16	Minimum Marks:24	40	

Instructions to the question paper setter:
The 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 hasshortanswertypequestionsconsistingofsixpartsof02markseach.Thecandidatewillattemptfivequestionsin 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:

- *TounderstandtheArchitectureof8085,8086anditsassemblylanguageProgramming*
- *To study the interfacing of peripheral devices*
- *Tounderstandthefeaturesof8-bit Microcontroller and system design*
- *Toexplorethefeaturesof16bitandhigherMicroprocessors'architectures*
- *To Design and Implement Microcontroller based Systems.*

UNIT	CONTENT	No. of Hrs.
I	**8085 Architecture and Organization:** Introduction to Microprocessor, Microcomputer system, Microprocessor operations, Internal Architecture of 8085, System Bus, Pin description of 8085, Need and generation of control signals, types of Registers & Timing and Control Unit. **Instruction set of 8085:** Instruction formats, addressing Modes, Timing effect of Addressing modes, Instruction set classification, Instruction Cycle, Machine cycles, Timing diagram, Stack and Subroutine, Interrupt types, interrupt systems and polling, Interrupt control logic, Assembly language programming	9
II	**Memory and I/O devices interface:** Serial and Parallel communication interface, Hardware (Circuit level) description of Registers, RAM, ROM and Secondary memories, DMA controller, memory mapped I/O & I/O mapped I/O, Generating Control Signals, Interfacing 2KX8 EPROM, 2KX8 RAM, Interfacing I/O ports to 8085, Hand shake Signals , Block diagram and working of PPI-8255, Interfacing 8255 to 8085 and LED Interface.	9
III	**Microcontroller 8051 - Building Blocks:** Microprocessor vs microcontroller; RIS Cvs CISC architectures, 8051 Architecture, Internal memory organization, Internal RAM structure, Processor status word, Types of Special Function Registers and their uses in 8051.architecture, pin configuration, flag-bits and PSW register, input-out put 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 8051assembly 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 the8085/8080A, Penram International Publishing, 1996
2. DAPattersonandJHHennessy,"ComputerOrganizationandDesignThehardwareandsoftwarein terface.Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, TataMcGrawHill,1991.
4. Kenneth J. Ayala,The8051Microcontroller,PenramInternationalPublishing,1996.
5. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and SystemDesign8085, 8086, 8051, 8096", PHIL earning Pvt. Ltd., Second Edition, 2013.
6. A. K. RayandK.M.Burchandi,andA.K.Ray,"AdvancedMicroprocessorandPeripherals",McGraw Hill international Edition, Third Edition,2017.
7. John B. Peatman,"DesignwithPICMicrocontrollers",PearsonEducation,2013.
8. Andrew N. Sloss Dominic Symes and Chris Wright,"ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaughmann/ElsevierPublishers,2006.
9. Muhammad Ali Mazidi, SarmadNaimi,SepehrNaimi,andJaniceMazidi,"ARMAssemblyLanguageProgramming& Architecture",IIEdition,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. Interfacevariousperipheralswithmicrocontrollersandprogrammesitforvarioussystems
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	3Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

The 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 hasshortanswertypequestionsconsistingofsixpartsof02markseach.Thecandidatewillattemptfivequestionsin 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:

- *Tounderstandthevariousamplitudemodulationanddemodulationtechniques&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 Side band System, Vestigial Side and System, Mathematical Representation of FM, Frequency Spectrum of AM Waves, Phase Modulation, Comparison Between Analog and Digital Modulation, Wide band 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, DSBS/ 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 Division Multiplexing.	**12**

Total Number of Hours= 36 + 12 = 48 Hrs

Text/Reference Books:

1. B.P.Lathi,ZhiDing"ModernDigitalandAnalogCommunication",Oxford,4thEdition,2011
2. HaykinS.,"CommunicationsSystems",JohnWileyandSons,2001.
3. ProakisJ.G.andSalehiM.,"CommunicationSystemsEngineering",PearsonEducation,2002.
4. TaubH.andSchillingD.L.,"PrinciplesofCommunicationSystems",TataMcGrawHill,2001.
5. Proakis J. G.,Digital Communications",4thEdition,McGrawHill,2000.
6. R. An and, 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 baseband/band pass analog transmission and detection.
3. Gain the knowledge of components of analog communication system
4. Compare and pass digital modulation techniques for biterrorrate, band width and power requirements.

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ECEPC-414 Electromagnetic Field 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:

The 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 hasshortanswertypequestionsconsistingofsixpartsof02markseach.Thecandidatewillattemptfivequestionsin 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:

1. *Understand basics of electrostatics and magnetostatics.*
2. *To learn basic electromagnetic equations and make students to have depth understanding of EM waves and the propagation of EM waves.*
3. *To impart knowledge on the basics of transmission lines*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Vectors And Coordinate Systems:** The del operator, gradient of a scalar, divergence of a vector, curl of a vector and their physical interpretations. Divergence 's theorem and stoke 's theorem, cartesian, cylindrical and spherical coordinate systems, conversion of coordinates of a point from one system to another.	12
II	**Electrostatics:** Review of electrostatic basics: coulomb 's law, electric field intensity, potential, gauss law and its applications for point charge, line charge density and surface charge density, boundary conditions for electric fields at dielectric-dielectric and dielectric-conductor interfaces, poisons and Laplace's equations. **Magnetostatics:** Review of magnetostatic basics: current densities, biot-savarts law, gauss law for magnetostatics, ampere 's circuital law, inconsistency of ampere 's circuital law – concept of displacement current, vector magnetic potential, boundary conditions for magnetic fields.	12

III	**Time Varying Fields:** Maxwell's equation in differential and integral vector form and their interpretations, Continuity of currents, Conduction and displacement current, Boundary conditions, Helmholtz equations, uniform plane wave in dielectric and conductor media, Skin effect and depth of penetration, reflection and refraction of plane waves at boundaries for normal incidence and surface impedance, Energy Flow and Poynting theorem.	12
IV	**Transmission Line:** Transmission line model, Parameters and properties of transmission line equations, Reflections in transmission lines, Voltage, current and impedance relations-open, Short circuit and matched lines, Standing wave ratio, Impedance matching, Quarter and half wave lines, Single stub and double stub matching.	12

Total Number of Hours =36+12 =48 Hrs

Text/ Reference Books:

1. R.K. Shevgaonkar,"ElectromagneticWaves",TataMcGrawHillIndia,2005.
2. E.C. Jordan & K. G. Balmain, "Electromagnetic waves & Radiating Systems", Prentice Hall, India, Second Edition,2007.
3. R.L. Yadav,"ElectromagneticFieldsandWaves",KhannaBookPublishing,2021
4. Narayana Rao, "N: Engineering Electromagnetics", Prentice Hall, India, ThirdEdition,1997.
5. William H. Hayt, "Engineering Electromagnetics", Mc GrawHill,FifthEdition,2008.
6. Elements of Engineering Electromagnetics by Matthew N.O. Sadiku, Oxford University Press.
7. Electromagnetic by J.D. Kraus, McGraw-Hill.

Course Outcomes:

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

1. Describe the fields using vector algebra and filed transformation from one co-ordinate system to other
2. Describe the force between charges and equipotential surfaces and electrostatic shielding/ screening.
3. Describe the magnetic field due to a current element and force on a charge particle due to magnetic field.
4. Describe the electromagnetic wave phenomenon and power carried by an electromagnetic wave.
5. Understand how the transmission line theory bridges the gap between circuit theory and field theory.

CSPC-414 Artificial Intelligence in Engineering							
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	3Hours
				Minimum Marks:16	Minimum Marks:24	40	

Instructions to the question paper setter:
The 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 hasshortanswertypequestionsconsistingofsixpartsof02markseach.Thecandidatewillattemptfivequestionsin 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 under lying 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 in AI and prepare students for careers in AI-related fields.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals of Artificial Intelligence (AI):** Introduction to AI, History of AI, General applications of AI, Need of AI in Engineering, Problem solving, Process of problem solving, breadth first search, depth first search, heuristics search techniques, best first search, Introduction to intelligent systems, Various approaches to AI: Cybernetics and brain simulation, Symbolic, Sub-symbolic, Statistical. **Ethical and Social Implications of AI:** Ethical considerations in AI development and deployment, Impact of AI on jobs and society, Regulatory and policy issues.	09
II	**Fundamentals of Machine Learning (ML):** Introduction to Machine Learning, datasets, Forms of Learning: Supervised and Unsupervised Learning, reinforcement learning, processes involved in Machine Learning, Applications of ML in Engineering. **Data Preprocessing, cleaning and normalization Approaches in Machine Learning (ML):** Data preprocessing, Data cleaning, Feature selection and extraction, Data normalization and scaling.	09

III	**Artificial Neural Networks:** Introduction to Artificial Neural Networks (ANNs): Definition and history of ANNs, Types of ANNs architectures, Basic architecture of ANNs, Activation functions, Singled- Layered and Multi-Layered Perceptron, Backpropagation algorithms, Applications of ANNs in Engineering.	**09**
IV	**Fuzzy Logic and Genetic Algorithm:** Introduction to Fuzzy Logic: Basic concepts, history, and fuzzy set theory. Processes in a fuzzy logic system, Applications of Fuzzy Logic in Engineering. **Genetic Algorithm (GA):** Basics of GA, Main operations of GA, Flowchart of GA, Working principle of GA in step by step, Applications in Engineering.	**09**

Total Number of Hours=36Hrs

Text/ Reference Books:

1. Russell and Norvig,—ArtificialIntelligence-AModernApproach‖,PearsonPrenticeHall.
2. D W Patterson, —Artificial Intelligence and Expert Systems‖, Prentice Hall of India.
3. B. Vegnanarayana,—Artificialneuralnetworks‖,PrenticeHalllofIndiaPLtd
4. Elaine Rich, KevinKnight,—ShivashankarB.Nair,ArtificialIntelligence‖,TataMcGrawHill.
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. Demonstrateproficiencyinapplyingscientificmethodtomodelsofmachinelearning
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	3Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

Instructions to the question paper setter:

The 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 knowledge systems, origin, evolution and the approaches used in ancient and modern times.*
- *To promote the youth to do research in the various fields of Bhartiya 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 master piece 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 approach to healthcare, Agriculture in Ancient India, Approaches and strategies to the protection and conservation of environment.	10

Total Number of Hours =24Hrs

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Text/ Reference Books:

1. BhagChandChauhan,IKS:TheKnowledgeofBharata,GarudaPrakashan,2023.
2. Pradeep Kohleet. Al. Pride of India-A Glimpse of India'sScientificHeritageeditedbySanskritBharati,2006.
3. Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd.,2010.
4. Sibaji Raha, etal, History of Science in IndiaVolume-1,Part-I,Part-II,VolumeVIII,NationalAcademyofSciences,Indiaand The Ramkrishna Mission Institute of Culture,Kolkata,2014.

Course Out comes (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 masterpiece like Natraja, delve into Vedas, and study the lives and works of prominentfiguressuchasAgastya,Valmiki,Patanjali,andAryabhatta,highlightingtheircontributionstoIndianculture.
3. Study engineering and technology during the Vedic and post- Vedicages, trace the history of mathematics and astronomy in India, and explore the contributions of scholars from institutions like Takshashila and Nalanda.
4. Examinetemplearchitecture,festivals,yoga,Ayurveda,andancientagriculturalpractices,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	3Hours
				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 Oscillator*
- *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 transist or 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 Opamp IC 741as: Inverting and Non-inverting amplifier.
7. To study the Opamp performance as differentiator and integrator for various time constants.
8. To study Schmitttrigger using opamp741.
9. To design and study the working of
   a) A stable Multivibrator b) MonostableMultivibratorusingIC741.
10. To study operation of op-ampas 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-2 R and l adder 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. Understandandcomparingtheoperationsofdifferentamplifierswiththeircharacteristics.
2. Knowledgetodesignandtestthedifferenttypesofoscillatorsforthegenerationofrequiredfrequency.
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*
- *AcquiringandapplyingmicrocontrollerProgrammingandinterfacingskills*

List of Experiments:(Performany Ten experiments)

1. On 8085 kit, find the Factorial of a number
2. On 8085 kit, find if a number is prime or a perfect square
3. On 8051 kit, write a program to perform serial data transfer
4. On 8051 kit, generate square wave for a given frequency and duty cycle
5. On cortex M3, write a program to perform LED binking
6. On cortex M3, write a program to verify Digital out
7. On cortex M3, write a program to display clock on 7-segment display
8. On cortex M3, write a program to generate Analog output
9. On cortex M3, write a program to read in Analog input
10. On cortex M3, write a program to debug using serial pc
11. On cortex M3, write a program to generate PWM output
12. On cortex M3, write a program to perform counting on LCD counter
13. On cortex M3, write a program to learn Interrupt function
14. On cortex M3, write a program to understand 12c master and slave communication
15. On Intel Galileo Gen 2, plot a graph for analog input
16. On Intel Galileo Gen 2 write an Array in Arduino.

Note: The concerned Course Coordinator will prepare the actual list of experiments/problems at the start of semester based on above generic list.

Course outcomes:

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

1. Write algorithms and programming task involved for a given problem
2. Design and develop modular programming skills
3. Trace and debug a program.

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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	3Hours
				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.*

ListofExperiments:(PerformanyTenexperimentsfromHardwareandSimulationsection)

Part -A: Hardware

1. Study of Amplitude Modulation -Mod & Demod.
2. Study of AM -DSBSC – 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/Lab view)

1. Study of Amplitude Modulation- Mod & Demod.
2. Study of AM- DSBSC- 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, including receiver design considerations (sensitivity, selectivity, fidelity), channel capacity analysis, and optimization of system performance.

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CSPC-414 PAI 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	3Hours
				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. The additional experiments may be performed by the respective institution depending on the infrastructure available. The experiments may be performed with application related to respective branch of engineering.

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 systems and its applications.
7. Write a program to implement Traveling salesman problem.
8. Write a program to implement four queens problem.
9. Write a program to solve monkey banana problem.
10. Write a program to implement Tower of Hanoi.
11. Case study related to implementation of algorithms in respective discipline for which Lab is being run.

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.

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	3Hours
				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 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.

Core group of faculty members may be appointed for evaluation of the Micro-Project and reviewing work at least two times within the semester.

Course Outcomes:

At the end of the microproject, students will demonstrate the ability to:

1. Identify and define problem statement from the requirements raised from literature survey /need analysis
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 to wards entrepreneurship.

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Exit Option for UG Diploma in Electronics and Communication Engineering

ECE-416P Internship-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	0	6	Maximum Marks: 30	Maximum Marks: 20	50	3 Hours

Eligibility for Exercising Exit Option and Pursuing Internship-I:

Those students without any backlogs who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Engineering during registration for 4th semester (only for regular students (admitted in first year) and not applicable for lateral entry students). 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.

List of activities/projects to be completed by student:

1. The appropriate ***area of internship shall be identified by student in consultation with the faculty mentor and industrial supervisor*** (if any) during the course of 4th semester, ***by learning all concepts being taught in previous semesters and demonstrating hard work and genuine desire to learn.***
2. The student shall clearly state in his brief report to faculty supervisor regarding (a)What he/she intends to learn, acquire and clarify through this internship? (b) Use of try to use concrete, measurable terms in listing his/her learning objectives under each of the following categories:
   a) ***Knowledge and Understanding***
   b) ***Skills***
3. The student will clearly state and describe in his brief reports regarding
   a) ***Learning Activities***: How will internship activities enable him/her to acquire the knowledge/understanding, and skills listed to be acquired by students (above)?
   b) ***On the job***: How internship activities will enable him/her to meet his/her learning objectives. Student should include *projects, research, report writing, conversations, etc., which student will do while working, relating them to what he/she intends to learn.*
   c) ***Teaching/Mentoring Activities:*** How his/her technical knowledge can be applied at the site of the internship to create value through mentoring/help people learn new things.
   d) ***Off the job:*** List of appropriate study material for reading, writing, method to keep contact with faculty supervisor, peer group discussion, field trips, observations, etc., he/she will make and carry out which will help him/her to meet his/her learning objectives.
   e) ***Evidences:*** *Student will describe* in detail what other evidence he/she will provide to attached faculty mentor to document what was learnt (e.g. journal, analytic paper, project, descriptive paper, oral presentation, etc.) Deadline dates should be included.
   f) ***Evaluation:*** The faculty or internship supervisor will provide a written evaluation, preferably in a tabular format, and by defining rubrics used for evaluation of internship.
   g) ***The Internship Job Description***: Student will describe about role and responsibilities while on his/her internship. (in as much detail as possible), about list of assigned /expected duties, project to be completed, deadlines, etc., and description of contribution expected by the organization/site of internship.

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4. The internship will be defended by student during 5th semester in front of appropriate committee (including faculty/ internship supervisor) as per schedule notified by academic department. The department concerned will review the Internship-I rigorously to discourage low quality internship work and to avoid exit options as an escape route, rather than a genuine learning curve.

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