HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.

Electrical and Electronics Engineering (EEE)

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	PC	EEEPC-311	Electronic Devices	3	0	0	3	40	60	100
2	PC	EEEPC-312	Digital System Design	3	0	0	3	40	60	100
3	PC	EEEPC-313	Electrical Machines – I	3	1	0	4	40	60	100
4	PC	EEEPC-314	Electrical Circuit Analysis	3	1	0	4	40	60	100
5	PC	EEEPC-315	Electromagnetic Waves	3	1	0	4	40	60	100
6	HS	IKS-311	Indian Knowledge System	2	0	0	2	40	60	100
Labs:										
1	PC	EEEPC-311P	Electronic Devices Lab	0	0	2	1	30	20	50
2	PC	EEEPC-312P	Digital System Design Lab	0	0	2	1	30	20	50
3	PC	EEEPC-313P	Electrical Machines – I Lab	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	FC	MAFC-311	Probability Theory andStatistics	3	1	0	4	40	60	100
2	PC	EEEPC-411	Analog Circuits	3	0	0	3	40	60	100
3	PC	EEEPC-412	Microcontrollers	3	0	0	3	40	60	100
4	PC	EEEPC-413	Electrical Machines – II	3	1	0	4	40	60	100
5	PC	CSPC- 414	Introduction to Artificial Intelligence	3	1	0	4	40	60	100
6	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	EEEPC-411P	Analog Circuits Lab	0	0	2	1	30	20	50
2	PC	EEEPC-412P	Microcontrollers Lab	0	0	2	1	30	20	50
3	PC	EEEPC-413P	Electrical Machines – II Lab	0	0	2	1	30	20	50
4	PC	CSPC-414P	AI Lab	0	0	2	1	30	20	50
5	EE	EEEEE-411P	Micro Project	0	0	2	1	60	40	100
Total				**17**	**3**	**10**	**25**	420	480	**900**
UG Diploma Exit Option										
1	EE	EEEEE-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 Diplomain Electrical and Electronics 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

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EEEPC-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 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 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 different biasing arrangements and H parameters circuits.*
- *To study the construction, operation and characteristics several special semiconductor devices.*
- *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

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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
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 applythe 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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EEEPC-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	

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 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 combinational and 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", PearsonEducation
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.

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EEEPC-313 Electrical Machines – I							
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:

- *Understand the fundamental principles governing electromechanical energy conversion, including magnetic circuits, Faraday's law of electromagnetic induction, and basic principles of energy conversion in electrical machines.*
- *Develop the ability to analyze the performance characteristics of electrical machines, including efficiency, power factor, torque-speed characteristics, and voltage regulation, through theoretical analysis and practical experimentation.*
- *Apply theoretical knowledge to design electrical machines for specific applications, considering factors such as load requirements, efficiency, and operating conditions, and comprehend the implications of design choices on machine performance.*
- *Acquire skills to troubleshoot common operational issues in electrical machines, identify factors affecting performance degradation, and implement maintenance practices to ensure optimal and safe operation throughout the machine's lifespan.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Magnetic fields and magnetic circuits:** Review of magnetic circuits - MMF, flux, reluctance, inductance; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	9

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II	**DC machines:** Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.	9
III	**DC machine - motoring and generation:** Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines	9
IV	**Transformers:** Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency, Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Three phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.	9

Total Number of Hours=36 Hrs

Text/Reference Books:

1) E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2) E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3) M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4) P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5) J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Course Outcomes:

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

1. Understand the concepts of magnetic circuits.
2. Understand the operation of DC machines.
3. Analyse the differences in operation of different DC machine configurations.
4. Analyse single phase and three phase transformers circuits

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EEEPC-314 Electrical Circuit Analysis							
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 familiarize basic laws, source transformations, theorems and methods of analyzing electrical circuits*
- *To analyze the behavior of circuit response in time domain and frequency domain and to understand the significance of network functions.*

COURSE CONTENT:

Unit	Content	No of Hrs
1	**Applications of AC theorems in AC Circuits:** Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Nodal and Mesh Analysis. **Graph theory** Introduction and graph of a network, The incidence matrix, Fundamental cut set matrix, Fundamental tie set matrix and loop currents, Relation between various matrices. Concept of duality and dual networks.	12
II	**Solution of First and Second order networks:** Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response. **Sinusoidal steady state analysis:** Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.	12

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III	**Electrical Circuit Analysis Using Laplace Transforms:** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Application of Laplace transforms in circuit analysis: Transformation of time domain circuit components to s- domain. **Transfer function representation:** Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances	12
IV	**Two Port Network and Network Functions:** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks. Condition for reciprocity and symmetry, Inter-relationship between the parameters. Interconnection of two port networks: Series, Parallel, Cascade and series-parallel connections. Hurwitz polynomial and its properties, Positive real functions, Properties of positive real functions	12

Total No of Hours : **36+12 = 48 Hrs**

Text / Reference Books:

1. M. E. Van Valkenburg, —Network Analysis, Prentice Hall, 2006.
2. D. Roy Choudhury, —Networks and Systems, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, —Engineering Circuit Analysis, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, —Electric Circuits, McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, —Basic Circuit Analysis, Jaico Publishers, 1999.

Course Outcomes:

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

1. Apply network theorems for the analysis of electrical circuits.
2. Obtain the transient and steady-state response of electrical circuits.
3. Analyze circuits in the sinusoidal steady-state (single-phase and three phase). Analyze two port circuit behavior.
4. Synthesize networks and filters.

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EEEPC-315 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

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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 Hertz dipole, Power radiated by hertz, dipole, thin linear antenna, Radiation Parameters of antenna, rEEEiving 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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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 knowledge systems,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

Total Number of Hours=24 Hrs

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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 Sanskrit Bharati, 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, National Academy 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 Indian culture.
3. Study engineering and technology during the Vedic and post-Vedic ages, trace the history of mathematics 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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EEEPC-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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EEEPC-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. Binaryto 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 studyof 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 studyof their timing 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. Binarycounter
   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 memorysize
10. Simulate the following circuits using VHDL/Verilog:

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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

1. Understand the number systems and IC characteristics
2. Understand the Boolean algebra and its properties
3. Design and analyse the combinational logic circuits
4. Get grip on HDL syntax.

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EEEPC-313P Electrical Machines – I 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 provide students with practical experience in the construction and operation of various electrical machines.*
- *Students learn how to perform experiments on these machines to validate their performance characteristics and gain the skills to select the correct machine for a specific application*

List of Experiments: (Perform any Ten experiments)

Note: A student to perform any 10 Experiments and make one minor working model project.

1. To perform the load test on a single phase transformer.
2. To perform open circuit and short circuit tests on a single phase transformer and hence draw the equivalent circuit, calculate the voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer underdifferent loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of a three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of DC machine and to draw sketches of differentcomponents.
8. To measure armature and field resistance of DC shunt generator and to obtain its open circuit characteristics.
9. To obtain load characteristics of DC shunt/series/compound generator.
10. To draw speed-torque and torque-speed characteristics of DC shunt/series /compoundgenerator.
11. To study the three point and four point DC motor starters.
12. To perform Swinburne's test (no load test) to determine various losses of DC shuntmotor.
13. To visualize the magnetic fields produced by a bar magnet and a current carrying coil using FEMM/ ANSYS Maxwell.
14. To visualize the magnetic field produced in an electrical machine using FEMM/ ANSYS Maxwell.

Course outcomes:

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

1. Analyze three-phase transformer/system connections.
2. Evaluation of equivalent circuit parameters, efficiency and voltage regulation by performing various tests on transformer.
3. Analyze parallel operation of transformers.
4. Analyze performance characteristics of DC generators

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SEMESTER IV

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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 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 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.*
- *Cover certain basic, important computer oriented numerical methods for analyzing problems that arise in engineering and physical sciences.*
- *To obtain solutions to a few problems that arise in their respective engineering courses.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Probability Space, Conditional Probability and Random Variables**: Probability space; Conditional probability and Baye"s theorem with examples; Random variables, Probability functions and Distribution function with examples, Combinatorial probability and sampling models.	12
II	**Discrete and Continuous Random Variables:** Binomial, Poisson, Geometric and Negative Binomial distributions with examples, Exponential, Gamma and Weibull distributions with examples and relation between the distributions.	10
III	**Two Dimensional and functions of Random Variables:** Two dimensional randomvariables, Joint distributions, Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds; Functions of one and two random variables. Moments; Characteristic functions of a random variable. Random sequences and Modes of Convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, Central Limit Theorem.	16
IV	**Numerical Methods:** Solutions of Algebraic and transcendental equations (Bisection and Newton Raphson's method), Numerical integration by trapezoidal and Simpson's rules 1/3 and 3/8 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.	10

Total Number of Hours=36+12=48 Hrs

Text/Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal processing," Third Edition, Pearson Education.
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
4. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981.
5. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
6. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing (2022).
7. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989.
8. R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.

Course outcomes:

At the end of this course students will demonstrate the ability 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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EEEPC-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 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 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*

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, 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

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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
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: 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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EEEPC-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 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 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.*

COURSE CONTENT:

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

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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 their uses 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 instructions, Logic instructions, branching instructions and Bit manipulation instructions.	9
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 hardware and 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 System Design 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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EEEPC-413 Electrical Machines – II							
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:

- *Understanding the operation of synchronous machines*
- *Understanding the analysis of power angle curve of a synchronous machine*
- *Understanding the equivalent circuit of a single phase transformer and single phase induction motor*
- *Understanding the circle diagram of an induction motor*
- *Analyzing the characteristics and performance of electrical machines*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Fundamentals of AC machine windings:** Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor	12
II	**Pulsating and revolving magnetic fields:** Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.	12

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III	**Induction Machines**: Concept of rotating magnetic field, Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and maximum torque, power flow diagram, Equivalent circuit. Phasor diagram, Losses and efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-fed induction machines. Single phase induction motors: Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications	**12**
IV	**Synchronous machines:** Constructional features, cylindrical rotor and salient pole synchronous machine - generated EMF, coil span and distribution factor, equivalent circuit and phasor diagram, armature reaction at different power factor loads, voltage regulation by synchronous impedance and zero power factor method, concept of short circuit ratio, Operating characteristics of synchronous machines, Vcurves and inverter-V curves. Hunting. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators – synchronization and load division.	**12**

Total Number of Hours=36+12=48 Hrs

Text/Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
6. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Course Outcomes:

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

2. Understand the concepts of rotating magnetic fields.
3. Understand the operation of AC machines.
4. Analyse performance characteristics of AC machines.
5. To understand the difference between the synchronous machines and asynchronous machines

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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 AItechniques to solve real-world problems.*
- ***Critically analyze AI applications****: Enable students to evaluate the ethical, social, andeconomic 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.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Introduction:** Introduction to artificial intelligence, background, possible approaches in 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 first search, 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 in first-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 societalimplications

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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:

1. Understand the basic definitions, nature, scope, and significance of economics.
2. Learn about the elasticity of demand, its types, methods of measurement, and its importance in economicanalysis.
3. Examine price determination under different market structures, including perfect competition, monopoly,monopolistic competition, and oligopoly.
4. 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 businesscycle.

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Course Learning Outcomes (CLOs):

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

1. Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply and demand curves on equilibrium price and output.
2. Determine the roles that prices and markets play in organizing and directing economic activity
3. Calculate and graph the short-run and long-run costs of production, supply and demand elasticities.
4. Describe governmental efforts to address market failure such as monopoly power, externalities, and public goods.
5. Examine and interpret a nation's economic performance indicators such as economic growth,unemployment and inflation from a macroeconomic perspective.
6. 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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EEEPC-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 studythe 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 requiredfrequency.
3. Knowledge to design and test the different types of converters.

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EEEPC-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 of two 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 rEEEption of character.
8. To interface 8253 programmemable interval timer to 8085 and verify the operation of 8253 in six different 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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EEEPC-413P Electrical Machines – II 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 expose the students to the operation of synchronous machines.*
- *To impart knowledge on voltage regulation of alternators.*
- *To expose the students to the operation of induction motors.*
- *To impart knowledge on equivalent circuit of the induction motors.*
- *To impart knowledge on necessity of starters.*

List of Experiments: (Perform any Ten experiments)

1. Load test on three-phase induction motor.
2. No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
3. Load test on single-phase induction motor.
4. No load and blocked rotor test on single-phase induction motor.
5. Separation of No-load losses of three-phase induction motor.
6. Regulation of three phase alternator by EMF and MMF methods.
7. Regulation of three phase alternator by ZPF and ASA methods.
8. Regulation of three phase salient pole alternator by slip test.
9. Measurements of negative sequence and zero sequence impedance of alternators.
10. V and Inverted V curves of Three Phase Synchronous Motor.
11. Study of Induction motor Starters.
12. Synchronization of Alternator

Course outcomes:

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

1. Ability to understand the importance of Induction machines.
2. Ability to acquire knowledge on separation of losses.
3. Ability to understand and analyze EMF and MMF methods.
4. Ability to understand the importance of Synchronous machines.

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CSPC-414P AI Lab							
Teaching Scheme			Credit	Marks Distribution			Duration of EndSemester 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 existingknowledge 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.

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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EEEEE-411P Micro Project							
Teaching Scheme			Credit	Marks Distribution			Duration of EndSemester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
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 electrical and electronic circuit building and testing for developing real life applications. The micro-project may be a complete hardware or hardware with small programming aspect. It should encompass electrical and 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 /need analysis
2. Build and Test electrical and electronic circuits/prototype for developing real life 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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