HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR

Syllabus & Examination Scheme

for

B. Tech.
Electrical Engineering (EE)

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	EEPC-311	Electrical Machines – I	3	1	0	4	40	60	100
2	PC	EEPC-312	Electrical Measurements and Measuring Instruments	3	0	0	3	40	60	100
3	PC	EEPC-313	Electrical Circuit Analysis	3	1	0	4	40	60	100
4	PC	EEPC-314	Electromagnetic Fields	3	1	0	4	40	60	100
5	PC	EEPC-315	Analog and Digital Electronics	3	0	0	3	40	60	100
6	HS	IKS-311	Indian Knowledge System	2	0	0	2	40	60	100
Labs:										
1	PC	EEPC-311P	Electrical Machines Laboratory - I	0	0	2	1	30	20	50
2	PC	EEPC-312P	Measurements and Instrumentation Laboratory	0	0	2	1	30	20	50
3	PC	EEPC-315P	Analog and Digital Electronics Laboratory	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	EEPC-411	Electrical Machines – II	3	1	0	4	40	60	100
3	PC	EEPC-412	Power Electronics	3	0	0	3	40	60	100
4	PC	ECEPC-412	Microcontrollers	3	0	0	3	40	60	100
5	ES	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	EEPC-411P	Electrical Machines Laboratory- II	0	0	2	1	30	20	50
2	PC	EEPC-412P	Power Electronics Laboratory	0	0	2	1	30	20	50
3	PC	ECEPC-412P	Microcontrollers Lab	0	0	2	1	30	20	50
4	ES	CSPC-414P	AI Lab	0	0	2	1	30	20	50
5	EE	EEEE-411P	Micro Project	0	0	2	1	60	40	100
Total				**17**	**4**	**8**	**25**	**390**	**460**	**850**
UG Diploma Exit Option										
1	EE	EEEE-415P	**Internship-I (Exit)**	**8 Weeks/ 2 Months**			**6**	50	50	100

Note:-

Those students who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Electrical 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 candidatesshall 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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EEPC-311 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
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 reactic gap flux density distribution with armature reaction.	9

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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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EEPC-312 Electrical Measurements and Measuring Instruments							
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:

- *Understanding instruments: Studying the operation of different types of instruments for measuring voltage, current, power, energy, resistance, inductance, capacitance, and frequency*
- *Understanding meters: Learning how different types of meters work and are constructed*
- *Using modern tools: Learning how to use modern tools for electrical projects*
- *Analyzing systems: Analyzing and designing electronic systems, interpreting power amplifier configurations, and designing feedback amplifiers*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	Classification and theory of Indicating Instruments - Classification of measuring instruments-Essential torques of indicating instruments – deflecting - controlling and damping torque - working principle of permanent magnet moving coil, dynamometer type and moving iron type instruments –torque equations-comparison of MC and MI instruments- Rectifier type instruments. Extension of range of DC voltmeter and ammeter – calculate values of shunt and multiplier– multi range instruments. Common errors in instruments and their remedies.	9
II	Measurement of Power and Energy - Construction of dynamometer type wattmeter – common errors and their remedies- multiplication factor –Working principle of single phase induction type energy meter – construction- common errors and their remedies. Construction of poly phase energy meters –2 elements and 3 element type. Calibration of energy meter by direct loading and phantom loading. TOD meter –functions-method of connection and use.	9

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III	Measurement of Resistance, Inductance and capacitance. Wheat stone bridge -simple problems. Difficulties in the measurement of high resistance– insulation Megger – working principle of Megger measurement of earth resistance and soil resistivity by earth tester. Localization of cable fault- Varley and Murray loop methods. Bridges- Maxwell's bridge-Schering bridge. LCR meter- applications.	**9**
IV	Instruments for special measurements - Measurement of frequency –working of vibrating reed type and indicating type frequency meters. Measurement of power factor –working principle of PF meters connection diagram of single phase and three phase PF meters. Working principle and connection diagram of synchroscope. Working principle and connection diagram of phase sequence indicator. Ramp type digital voltmeters-block diagram -working principle. Digital Storage oscilloscope- classification- block diagram of digital oscilloscope – applications of DSO - Observation of waveforms measurement of – voltage - frequency - time period - phase and phase angle	**9**

Total Number of Hours=36 Hrs

Text/Reference Books:

1. A.K Sawhney. Electrical and Electronics measurements and Instrumentation: DhanapathRay & co.
2. J.B Gupta. Electrical measurements and measuring instruments: S K Kataria & sons.
3. R K Rajput. Electrical measurements and measuring instruments: S Chand & co.
4. Edward William Golding, Frederick Charles Widdis. Electrical measurements and measuring instruments: Pitman

Course Outcomes:

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

1. Develop the knowledge of theoretical and mathematical principles of electricalmeasuring instruments.
2. Examine various real life situations in domestic or industrial scenario wheremeasurements of electrical quantities are essential.
3. Assess fault conditions in electrical installations and identify necessary remedialmeasures.
4. Design new sensing and measuring schemes for various electrical and electronicapplications.

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EEPC-313 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

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	**12**
	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	
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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EEPC-314 Electromagnetic Fields							
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 learn the fundamental concepts applied in Electrostatics, Magnetostatics, Time varying fields and Electromagnetic Waves. To apply the principles of Electromagnetic Field Theory for the design and analysis of Power Transmission lines.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Review of Vector Calculus:** Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus- differentiation, partial differentiation, integration, vector operator, del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.	12
II	**Static Electric Field:** Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.	12
III	**Magnetic Forces, and Inductance:** Biot-Savart's law, Ampere's law of force, Ampere's circuital law, Faraday's law, Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, calculations of inductances and mutual inductances for a solenoid and toroid.	12

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IV	**Maxwell's Equations in Time Varying Fields and Wave theory:** Concept of displacement current and conduction current, Maxwell's equation-differential and integral form, Poynting's theorem, its significance and Poynting's vector, Boundary Conditions. **Wave theory:** Derivation of wave equation, uniform plane waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Attenuation, phase and propagation constant, intrinsic impedance, Relation between E & H, wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect.	12

Total Number of Hours=36+12=48 Hrs

Text/Reference Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012

Course Outcomes:

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

1. To understand the basic laws of electromagnetism.
2. To obtain the electric and magnetic fields for simple configurations under static conditions.
3. To understand Maxwell's equation in different forms and different media.
4. To understand the propagation of EM waves.

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EEPC-315 Analog and Digital Electronics							
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:

- *The course objectives of Analog and Digital Electronics typically focus on providing students with fundamental knowledge, skills, and practical experience in both analog and digital circuits.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Diodes and Applications:** Junction diode characteristics: Open circuited p-n junction, p-n junction as a rectifier, V-I characteristics, effect of temperature, diode resistance, diffusion capacitance, diode switching times, breakdown diodes, Tunnel diodes, photo diode, LED. Diode Applications - clipping circuits, comparators, Half wave rectifier, Full wave rectifier, rectifier with capacitor filter.	09
II	**BJTs: Transistor characteristics:** The junction transistor, transistor as an amplifier, CB, CE, CC configurations, comparison of transistor configurations, the operating point, self-bias or Emitter bias, bias compensation, thermal runaway and stability, transistor at low frequencies, CE amplifier response, gain bandwidth product, Emitter follower, RC coupled amplifier, two cascaded CE and multistage CE amplifiers.	09
III	**FETs and Digital Circuits: FETs:** JFET, V-I characteristics, MOSFET, low frequency CS and CD amplifiers. **Digital Circuits:** Digital (binary) operations of a system, OR gate, AND gate, NOT, EXCLUSIVE OR gate, De Morgan Laws, NAND and NOR DTL gates, modified DTL gates, HTL and TTL gates, output stages, RTL and DCTL, CMOS, Comparison of logic families.	09

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IV	**Combinational Logic Circuits:** Basic Theorems and Properties of Boolean Algebra, Canonical and Standard Forms, Digital Logic Gates, The Map Method, Product-of-Sums Simplification, Don't-Care Conditions, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers. **Sequential Logic Circuits:** Sequential Circuits, Storage Elements: Latches and flip flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Shift Registers, Ripple Counters, Synchronous Counters, Random-Access Memory, Read-Only Memory.	**09**

Total Number of Hours = 36 Hrs

Text/Reference Books:

1. Integrated Electronics: Analog and Digital Circuits and Systems, 2/e, Jaccob Millman, Christos Halkias and Chethan D. Parikh, Tata McGraw-Hill Education, India, 2010.
2. Digital Design, 5/e, Morris Mano and Michael D. Cilette, Pearson, 2011.
3. Electronic Devices and Circuits, Jimmy J Cathey, Schaum's outline series, 1988.
4. Digital Principles, 3/e, Roger L. Tokheim, Schaum's outline series, 1994.
5. NPTEL Web Course: https://nptel.ac.in/courses/108102095, https://nptel.ac.in/courses/117106086
6. NPTEL Video Course: https://nptel.ac.in/courses/108102095, https://nptel.ac.in/courses/117106086
7. GATE SYLLABUS: Digital Logic: Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

Course outcomes:

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

1. Know the characteristics of various components.
2. Understand the utilization of components.
3. Learn Postulates of Boolean algebra and to minimize combinational functions.
4. Design and analyze combinational and sequential circuits.

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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.

EEPC-311P Electrical Machines Laboratory - I							
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 hencedraw 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 /compound generator.
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 shunt motor.
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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EEPC-312P Measurements and Instrumentation Laboratory							
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 calibrate LPF Watt Meter, energy meter, P. F Meter using electro dynamo meter type instrument as the standard instrument*
- *To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges*
- *To determine three phase active & reactive powers using single wattmeter method practically*
- *To determine the ratio and phase angle errors of current transformer and potential transformer.*

List of Experiments: (Perform any Ten experiments)

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

1. Calibration and Testing of single phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMCvoltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering bridge & Anderson bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.
9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.
11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle ofgiven CT by Null method.
12. PT testing by comparison – V. G. as Null detector – Measurement of % ratio errorand phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.
15. Measurement of % ratio error and phase angle of given CT by comparison.

Course outcomes:

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

1. To choose electrical instruments.
2. Test any instrument.
3. Find the accuracy of any instrument by performing experiment.
4. Calibrate PMMC instrument using D.C potentiometer.
5. Importance of Synchronous machines.

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EEPC-315P Analog and Digital Electronics Laboratory							
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 present a problem oriented introductory knowledge of Analogue & Digital circuits and its applications.*
- *To focus on the study of electronic circuits.*

List of Experiments:

Note: A student to perform any 8-10 Experiments and make one working minor project.

1 To verify the application op-amp as inverting amplifier.
2 To verify the application op-amp as Non- inverting amplifier.
3 To verify the application op-amp as integrator..
4 To verify the application op-amp as diffrentiator.
5 To verify the application of IC 555 as an astable multivibrator.
6 To verify the application of IC 555 as an monostable multivibrator.
7 To study about RS flip flop, clocked RS flip flop, JK flip flop.
8 To study about various type of logic gates.
9 To verify op-amp as triangular Wave generator.
10 To verify op-amp as square Wave generator.
11. Design and test S-R flip-flop using NOR/NAND gates.
12. Design, fabricate and test a switch debouncer using 7400.
13. Verify the truth table of a JK flip flop using IC 7476,
14. Verify the truth table of a D flip flop using IC 7474 and study its operation in the toggle and asynchronous mode.

Course outcomes:

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

1. Develop proficiency in using laboratory equipment such as oscilloscopes, function generators, power supplies, and breadboards to assemble, test, and troubleshoot analog and digital circuits.
2. Apply theoretical knowledge acquired in the classroom to analyze, design, and build analog circuits (e.g., amplifiers, filters, oscillators) and digital circuits (e.g., logic gates, flip-flops, counters).
3. Conduct experiments to verify fundamental principles and concepts of analog and digital electronics.
4. Develop troubleshooting skills by identifying and rectifying faults in analog and digital circuits.

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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, T[illegible] series method, Euler's method, Modified Euler's method, Runge's and Runge- Kutta me	10

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Total Number of Hours=36+12=48 Hrs

Text/Reference Books:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications toSignal processing," Third Edition, Pearson Education.
2. Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and StochasticProcesses," 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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EEPC-411 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

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

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EEPC-412 Power Electronics							
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:

- *The main objective of power electronics is to develop efficient, economical, and compact techniques for transforming and regulating electrical energy between different forms.*
- *Power electronics is a branch of electrical engineering that deals with processing high voltages and currents to deliver power for a variety of needs.*

COURSE CONTENT:

UNIT	CONTENT	No. of Hrs.
I	**Power switching devices :** Diode, Thyristor, MOSFET, IGBT: V-I characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.	12
II	**Thyristor rectifiers :** Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with Rload and highly inductive load; Input current wave shape and power factor.	12
III	**DC-DC buck converter:** Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. DC-DC boost converter: Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.	12

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IV	**Single-phase voltage source inverter :** Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage. Three-phase voltage source inverter: Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation	**12**

Total Number of Hours = 36+12=48 Hrs

Text/Reference Books:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. P. S. Bimbhra, Power Electronics", Khanna Publishers

Course Outcomes:

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

1. Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits.
3. Analyse the operation of DC-DC choppers.
4. Analyse the operation of voltage source inverters.

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

Total Number of Hours = 36Hrs

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The 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

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:

- 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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EEPC-411P Electrical Machines Laboratory- II							
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

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EEPC-412P Power Electronics Laboratory							
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 objectives of a power electronics laboratory course are to provide students with practical experience in power electronics concepts and design techniques.*
- *The course may also introduce students to industrial control of power electronic circuits, safe electrical connections, and measurement practices*

(Perform any Ten experiments)

List of Experiments: simulation and hard ware based

1. To plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
3. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
4. Study of the microprocessor-based firing control of a bridge converter.
5. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
6. To study Jones chopper or any chopper circuit to check the performance.
7. Thyristorised speed control of a D.C. Motor.
8. Speed Control of induction motor using thyristors.
9. Study of series inverter circuit and to check its performance.
10. Study of a single-phase cycloconverter.
11. To check the performance of a McMurray half-bridge inverter.

Course Outcomes:

1. Understand the properties and characteristics of thyristors.
2. Understand the different types of waveforms of inverter and chopper circuits.
3. Analyze speed and direction control of single phase and three phase electric motors using ac and dc drive.
4. Understand the effect of free-wheeling diode on pf with RL load.

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

Course Objective:

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

List of Experiments: (Perform any Ten experiments)

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

Course outcomes:

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

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

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

Course Objective:

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

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. 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.

EEEE-411P Micro Project							
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: 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 circuit building and testing for developing real life small electronic applications. The micro-project may be a complete hardware or hardware with small programming aspect. It should encompass electrical components, devices, analog or digital ICs, micro controller etc. Micro-Project should cater to a small system required in laboratory or real-life application. Based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Micro-project.

Course Outcomes:

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

1. Identify and define a problem statement from the requirements raised from literature survey /needanalysis
2. Build and Test electrical 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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