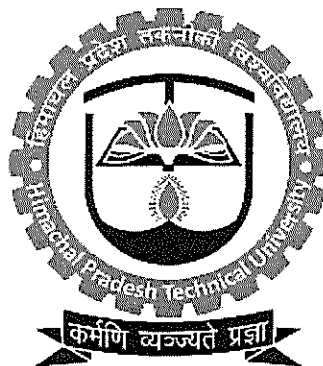


**HIMACHAL PRADESH TECHNICAL UNIVERSITY
HAMIRPUR**



**Syllabus & Examination
Scheme**

for

B. Tech.

Electrical & Electronics Engineering (EEE)

3rd to 4th Semester

As per National Education Policy (NEP)-2020

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

Semester-III

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	PC	EEEEPC-311	Electronic Devices	3	0	0	3	40	60	100
2	PC	EEEEPC-312	Digital System Design	3	0	0	3	40	60	100
3	PC	EEEEPC-313	Electrical Machines – I	3	1	0	4	40	60	100
4	PC	EEEEPC-314	Electrical Circuit Analysis	3	1	0	4	40	60	100
5	PC	EEEEPC-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	EEEEPC-311P	Electronic Devices Lab	0	0	2	1	30	20	50
2	PC	EEEEPC-312P	Digital System Design Lab	0	0	2	1	30	20	50
3	PC	EEEEPC-313P	Electrical Machines – I Lab	0	0	2	1	30	20	50
Total				17	3	6	23	330	420	750

Semester-IV

Sr. No.	Category	Subject Code	Subject Title	L	T	P/D	Credits	Evaluation Scheme (Marks)		
								Internal Assessment (IA)	ESE	Subject Total
Theory:										
1	FC	MAFC-311	Probability Theory and Statistics	3	1	0	4	40	60	100
2	PC	ECEPC-411	Analog Circuits	3	1	0	4	40	60	100
3	PC	ECEPC-412	Microcontrollers	3	0	0	3	40	60	100
4	PC	EEPC-411	Electrical Machines–II	3	1	0	4	40	60	100
5	PC	CSPC- 414	Artificial Intelligence in Engineering	3	0	0	3	40	60	100
6	HS	HS-311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	ECEPC-411P	Analog Circuits Lab	0	0	2	1	30	20	50
2	PC	ECEPC-412P	Microcontrollers Lab	0	0	2	1	30	20	50
3	PC	EEPC-411P	Electrical Machines Laboratory-II	0	0	2	1	30	20	50
4	PC	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	3	10	25	420	480	900
Exit Option to 2- Year UG Diploma										


Dean - Academic

1	INT	EEE-416P	Internship-I(Exit)**	8Weeks/ 2Months	6	30	20	50
---	-----	----------	----------------------	--------------------	---	----	----	----

Note:

***Common Subject**

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

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


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

SEMESTER-III



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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, Dhrubus 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, New Delhi, 2021.
7. A.K. Maini, Analog Electronics, Khanna Book Publishing, New Delhi, 2022.

Course Outcomes:

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

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


Dean - Academic

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, Programmable 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	<p>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.</p> <p>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.</p>	9
II	<p>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 .</p> <p>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 Programmable logic devices like FPGA, Logic implementation using Programmable Devices.</p>	9


Dean - Academic
H.P. Technical University
Hamirpur - 177 004, HP

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", Pearson Education
6. Douglas-Hall, "Digital Circuits and Systems", Tata McGraw Hill
7. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill.

Course Outcomes:

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

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



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

Dean - Academic
H. P. Technical University
Hamirpur - 177 001, HP

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


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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
I	<p>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.</p> <p>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.</p>	12
II	<p>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.</p> <p>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.</p>	12


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

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.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

Dean - Academic
H.P. Technical University
Hamilton - 177 001 100

EEEP-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


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

III	<p>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.</p> <p>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.</p>	12
IV	<p>Radiation: Solution for magnetic vector potential function, Radiation from the Hertz dipole, Power radiated by hertz, dipole, thin linear antenna, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna, Fourier transform relation between current and radiation pattern.</p>	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, "Engineering 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.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

Hamburg - 133 001 111
H.P. Technical University
Dept. - Academic

IKS-311 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		C	Internal Assessment	End Semester Examination	
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 approach to healthcare, Agriculture in Ancient India, Approaches and strategies to the protection and conservation of environment.	10

Total Number of Hours=24 Hrs


Dean - Academic
H.P. Technical University

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 masterpieces like Natraja, delve into Vedas, and study the lives and works of prominent figures such as Agastya, Valmiki, Patanjali, and Aryabhata, 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.


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

H. P. Technical University
Hamburg - 175 001, BRD
Dean - Academic

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.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

Page 133 of 133
H. P. Technical University
Hamburg - 133 001

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:

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


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

- 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.



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

Dean - Academic
H P Technical University
Hamilton - 177 001 HP

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.

- To perform the load test on a single phase transformer.
- 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.
- To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
- To perform parallel operation of two single phase transformers.
- To study the various connections of a three phase transformer.
- To perform Scott connections on three phase transformer to get two phase supply.
- To study the constructional details of DC machine and to draw sketches of different components.
- To measure armature and field resistance of DC shunt generator and to obtain its open circuit characteristics.
- To obtain load characteristics of DC shunt/series/compound generator.
- To draw speed-torque and torque-speed characteristics of DC shunt/series/compound generator.
- To study the three point and four point DC motor starters.
- To perform Swinburne's test (no load test) to determine various losses of DC shunt motor.
- To visualize the magnetic fields produced by a bar magnet and a current carrying coil using FEMM/ ANSYS Maxwell.
- 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

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



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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 and Statistics	3	1	0	4	40	60	100
2	PC	ECEPC-411	Analog Circuits	3	1	0	4	40	60	100
3	PC	ECEPC-412	Microcontrollers	3	0	0	3	40	60	100
4	PC	EEPC- 411	Electrical Machines–II	3	1	0	4	40	60	100
5	PC	CSPC- 414	Artificial Intelligence in Engineering	3	0	0	3	40	60	100
6	HS	HS - 311	Engineering Economics	2	0	0	2	40	60	100
Labs:										
1	PC	ECEPC-411P	Analog Circuits Lab	0	0	2	1	30	20	50
2	PC	ECEPC-412P	Microcontrollers Lab	0	0	2	1	30	20	50
3	PC	EEPC-411P	Electrical Machines Laboratory-II	0	0	2	1	30	20	50
4	PC	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	3	10	25	420	480	900
Exit Option to 2- Year UG Diploma										
1	INT	EEE- 416P	Internship-I (Exit)**	8Weeks/2Months			6	30	20	50

Note:

***Common Subject**

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

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


 Dean Academic
 H. P. Technical University
 Hamirpur - 177 001, HP

SEMESTER IV

				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	MaximumMarks:40	MaximumMarks:60	100	3Hours
				MinimumMarks:16	MinimumMarks:24	40	

Instructions to the question paper setter:

The question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 2 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 all life phenomena.
- To understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- To analyse the response of random inputs to linear time invariant systems.

COURSE-CONTENT:

UNIT	CONTENT	No. of Hrs.
I	Probability Theory: Counting principles, probability axioms, sample space and events, conditional probability & Baye's Theorem. Random variable, discrete & continuous probability distribution, expectation, variance, standard deviation. Joint probability distribution, mass function, distribution function, marginal distribution function, covariance. Probability Distributions: Discrete Probability Distributions: Uniform, Bernoulli, Binomial Distribution and Poisson distribution. Continuous Probability Distributions: Normal and exponential distribution.	12
II	Sampling and Testing of Hypothesis: Basic sampling models, sampling distribution of mean and standard deviation, testing of hypothesis, level of significance, confidence intervals for known and unknown means, simple sampling of attributes, tests of significance for large samples, comparison of large samples, central limit theorem, test of significance for two large samples. Student's t- test, Chi-square test, Goodness of fit, F-distribution	12
III	Solution of System of Linear, Transcendental Equations & Interpolation Bisection method, Regula-Falsi method Newton Raphson's method, Gauss elimination method, LU factorization method. Introduction to Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Difference operators and relations.	12
IV	Numerical Differentiation & Integration: Numerical differentiation using forward difference, backward difference and central difference formula. Integration by trapezoidal and Simpson's rules 1/3rd and 3/8th 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.	12


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

Total Number of Hours =36+12=48Hrs

Text books:

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

Reference Books:

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

Course outcomes:

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

1. Develop understandings of basics of probability theory.
2. Identify different distributions 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.



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

ECEPC-411 Analog Circuits							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
3	1	0	4	MaximumMarks:40	MaximumMarks:60	100	3Hours
				MinimumMarks:16	MinimumMarks:24	40	

Instructions to the question paper setter:

The question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 2 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	<p>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.</p> <p>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.</p>	9
II	<p>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.</p> <p>Tuned Amplifier: General behavior of tuned amplifiers, Advantages and disadvantages of tuned amplifier, Single tuned amplifier, Frequency response of single tuned amplifier, Double tuned amplifier and its frequency response.</p>	9


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

III	Feedback Amplifier: Introduction, Classification of feedback, Characteristics of negative feedback, Feedback topologies: Voltage series, Voltage shunt, currents 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-2 R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.	9

Total Number of Hours=36 Hrs

Text/ Reference Books:

1. A. V. N. Tilak, Design of Analog Circuits, Khanna PublishingHouse,2022.
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, Mc Graw Hill, 1992.
3. P. 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, JohnWiley,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


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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

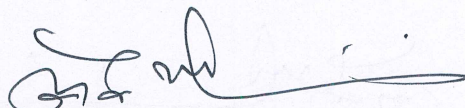
Instructions to the question paper setter:

The question paper for the end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 2 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 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 Micro controller-based Systems.

UNIT	CONTENT	No. of Hrs.
I	8085 Architecture and Organization: Introduction to Microprocessor, Microcomputer system, Microprocessor operations, Internal Architecture of 8085, System Bus, Pin description of 8085, Need and generation of control signals, types of Registers & Timing and Control Unit. Instruction set of 8085: Instruction formats, addressing Modes, Timing effect of Addressing modes, Instruction set classification, Instruction Cycle, Machine cycles, Timing diagram, Stack and Subroutine, Interrupt types, interrupt systems and polling, Interrupt control logic, Assembly language programming	9
II	Memory and I/O devices interface: Serial and Parallel communication interface, Hardware (Circuit level) description of Registers, RAM, ROM and Secondary memories, DMA controller, memory mapped I/O & I/O mapped I/O, Generating Control Signals, Interfacing 2KX8 EPROM, 2KX8 RAM, Interfacing I/O ports to 8085, Hand shake Signals, Block diagram and working of PPI-8255, Interfacing 8255 to 8085 and LED Interface.	9
III	Microcontroller 8051 - Building Blocks: Microprocessor vs microcontroller; RIS Cvs CISC architectures, 8051 Architecture, Internal memory organization, Internal RAM structure, Processor status word, Types of Special Function Registers and their uses in 8051. Architecture, pin configuration, flag-bits and PSW register, input-output ports, register banks and stack. Instruction set of 8051: Addressing modes, Data transfer instructions, Arithmetic	9


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

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

Total Number of Hours= 36Hrs

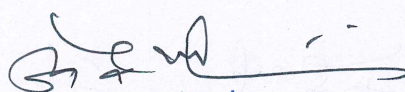
Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. DA Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface, Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata Mc Graw 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 " Guide Designing and Optimizing System Software", Morgan Kaughmann/ Elsevier Publishers, 2006.
9. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, 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
Design and implement real-life engineering applications


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

				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:

The question paper of end semester examination will be of 60 marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 2 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 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	3-Phase Induction Motors: Construction & working principle of three phase induction motors, 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. Slip and its effect on rotor parameters: rotor frequency, Torque-slip characteristics, Phasor diagram, Equivalent circuits, Expression for torque, maximum torque, starting torque and output power, Power flow diagram, Efficiency, No-load test, Blocked rotor test, Power circle diagram, power factor control of three phase induction motor, Starting methods, Speed control methods, Crawling, Cogging, Deep cage and Double cage rotors, Applications, Self excited and grid connected induction generator.	12
II	Fractional kW Motors/1-phase induction motors: 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. Classification, Principle of operation on the basis of double revolving field theory, Equivalent circuit, Determination of equivalent circuit parameters, Starting methods, Split phase induction motor, Capacitor motor, Permanent split capacitor motor; Shaded pole motor, Universal motor, Stepper motor.	12


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

III	Synchronous Generators/Alternators: Introduction, Comparison with DC generator, Advantages of rotating field over rotating armature, Constructional features, Excitation systems, Armature windings, EMF equation, Winding factors, Harmonics, Armature reaction: Unity power factor, Zero lagging and Zero leading power factor, Armature reaction reactance, Equivalent circuit of an alternator, Voltage equation, Phasor diagram of a loaded alternator for various types of loads, Voltage regulation and its methods of estimation, Load characteristic of alternators, Two reaction theory and torque-angle characteristic of a salient-pole alternator, Maximum reactive power for a salient-pole alternator, Losses and efficiency, Determination of X_d and X_q , Parallel operation of alternators, Synchronizing procedures, Synchronizing power and torque co-efficient, Damper Windings, Hunting.	12
IV	Synchronous Motors: Introduction, Construction, Principle of operation, Main features, Voltage equation, Equivalent circuit and phasor diagram of a cylindrical rotor synchronous motor, Effect of varying excitation and load changes, Synchronous motor V curves and inverted V curves, Starting of synchronous motors, Hunting, synchronous condenser, Applications of synchronous motors.	12

Total Number of Hours=36+12=48Hrs

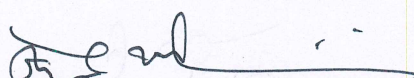
Text/Reference Books:

1. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", Mc Graw 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", Mc Graw Hill Education, 2010.
5. A. S. Langsdorf, "Alternating current machines", Mc Graw 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: Explain characteristics of induction machines from the testing data available.
- 2: Draw and explain circle diagram for induction machines.
- 3: Carry out calculations for various parameters of synchronous machines.
- 4: Explain various phenomena associated with synchronous machines.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

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

Instructions to the question paper setter:

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

Course Objective:

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

COURSE-CONTENT:

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


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

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

Total Number of Hours = 36Hrs


Text/Reference Books:

1. Russell and Norvig, —Artificial Intelligence – A Modern Approach, Pearson Prentice Hall.
2. D W Patterson, Artificial Intelligence and Expert Systems, Prentice Hall of India.
3. B. Vegnanarayana,—Artificialneuralnetworks,PrenticeHall of IndiaPLtd
4. Elaine Rich, Kevin Knight,—ShivashankarB.Nair,ArtificialIntelligence,TataMcGrawHill.
5. Nils J Nilsson,—Artificial Intelligence A New Synthesis, Morgan Kaufmann

Course Outcomes:

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

1. Demonstrate fundamental understanding of Artificial Intelligence (AI) and its foundation
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning
3. 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 social implications.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

				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:

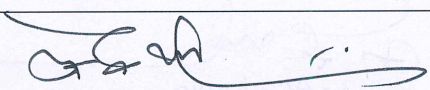
The question paper for the end semester examination will be of 60 marks. The question paper will consist of five sections, B, C, D and E. Sections A, B, C and D will have 2 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidate 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:

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 economic analysis.
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.

COURSE CONTENT:

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 to 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 Long-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.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

Course Outcomes (COs):

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

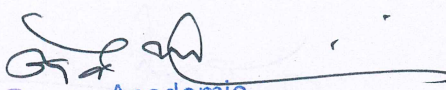
1. Identify the determinants of supply and demand; demonstrate the impact of shifts in both market supply and demand curves on equilibrium price and output.
2. Determine the roles that prices and markets play in organizing and directing economic activity
3. Calculate and graph the short- run and long- 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 interpretation'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 macroeconomy.

Textbooks:

1. Steven A. Greenlaw, David Shapiro, **"Principles of Economics"**, 2nd Edition, Rice University Open S tax, 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.


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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

Course Objective:

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

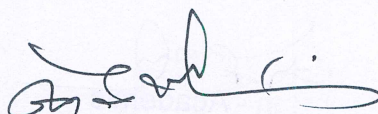
List of Experiments: (Perform any Ten experiments)

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 Opamp IC 741 as: Inverting and Non- inverting amplifier.
7. To study the opamp performance as differentiator and integrator for various time constants.
8. To study Schmitt trigger using opamp 741.
9. To design and study the working of a) Astable Multivibrator b) Monostable Multivibrator using IC 741.
10. To study operation of op-amp as V to I and I to V converters.
11. Design of Oscillators for the given Specifications: RC Phase shift Oscillators b. Colpitts Oscillator c. Hartley Oscillator
12. To study the performance of R-2R and ladder type DAC circuit.
13. To study the performance of successive approximation type ADC.

Course outcomes:

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

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



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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	3Hours
				Minimum Marks:12	Minimum Marks:08	20	

Course Objective:

- 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)

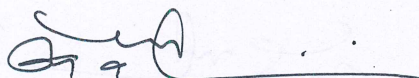
1. On 8085 kit, find the Factorial of a number
2. On 8085 kit, find if a number is prime or a perfect square
3. On 8051 kit, write a program to perform serial data transfer
4. On 8051 kit, generate square wave for a given frequency and duty cycle
5. On cortex M3, write a program to perform LED blinking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

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

Course outcomes:

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

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



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

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	3Hours
				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 motor.
- To impart knowledge on necessity of starters.

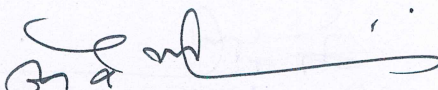
List of Experiments: (Perform any Ten experiments)

1. To perform no load and block rotor test on three phase induction motor to:
 - (a) Determining the equivalent circuit parameter.
 - (b) Draw the power circle diagram
2. To study the starting methods of three-phase induction motor.
3. To study the cascading of two induction motors.
4. To conduct the load test on three-phase induction motor for determine its performance characteristics.
5. To study speed changing by pole changing method.
6. To Obtain Open Circuit and short circuit characteristics of a synchronous generator and calculate its synchronous impedance Z_s .
8. To perform load test on self-excited induction generator.
9. To perform starting and the synchronization of three phase synchronous machine by light and dark lamp method.
10. To conduct slip test on the salient pole synchronous machine and calculate X_d and X_q parameters.
11. To measure the zero sequence reactance of synchronous machine.
12. To plot V & inverted V curves of a synchronous motor.

Course outcomes:

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

1. Ability to gain knowledge of various parts of a electrical machine.
2. Ability to conduct experiments on A.C. Machines to find the characteristics.
3. Able to calculate torque and speed of given rotating machine.


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

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	3Hours
				Minimum Marks:12	Minimum Marks:08	20	

Course Objective:

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

Following is the list of experiments out of which minimum 08 experiments must be performed in the lab. The additional experiments may be performed by the respective institution depending on the infrastructure available. The experiments may be performed with application related to respective branches of engineering.

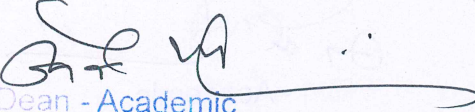
List of experiments:

- Write a program to implement breadth first search algorithm.
- Write program to implement depth first search algorithm.
- Write a program to implement the Hill Climbing algorithm.
- Write program to build and display Neural network using Tenser flow Keres.
- Write a program to implement Genetic algorithm.
- Study of expert system tools and its applications.
- Write a program to implement Traveling salesman problem.
- Write a program to implement four queen problem.
- Write a program to solve monkey banana problem.
- Write a program to implement Tower of Hanoi.
- Case study related to implementation of algorithms in respective discipline for which Lab is being run.

Course outcomes:

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

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


 Dean - Academic
 H.P. Technical University
 Hamirpur - 177 001, HP

EEEEEE-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	3Hours
				Minimum Marks:24	Minimum Marks:16	40	

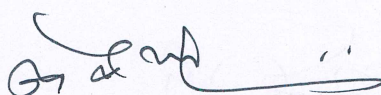
Guidelines: The micro-project is a team activity having 3-4 students in a team. This is electrical and electronic circuit building and testing for developing real life applications. The micro-project may be complete hardware or hardware with small programming aspect. It should encompass electrical and 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.

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

Course Outcomes:

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

1. Identify and define 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.



Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

Exit Option for UG Diploma in Electrical and Electronics Engineering

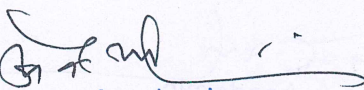
EEE-416P Internship-I							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Exam	Total	
0	0	0	6	Maximum Marks: 30	Maximum Marks: 20	50	3Hours

Eligibility for Exercising Exit Option and Pursuing Internship-I:

Those students without any backlogs who wish to leave the studies after completion/end of 2nd year, can exercise exit option for UG Diploma in Engineering during registration for 4th semester (only for regular students (admitted in first year) and not applicable for lateral entry students). They will be required to obtain additional 6 credits summer internship (Internship-I (Exit)) of 8-weeks/2-months duration during summer term/summer vacations after 4th semester. The evaluation of such candidates shall be done within the first-two months of the running next semester i.e. 5th sem. The internship shall be completed by student during summer vacations after 4th semester, in local industry, government/private organization, entrepreneurs, craft and skilled persons for on-site experiential learning.

List of activities/projects to be completed by student:

1. The appropriate *area of internship shall be identified by student in consultation with the faculty mentor and industrial supervisor* (if any) during the course of 4th semester, *by learning all concepts being taught in previous semesters and demonstrating hard work and genuine desire to learn.*
2. The student shall clearly state in his brief report to faculty supervisor regarding (a) What he/she intends to learn, acquire and clarify through this internship? (b) Use of try to use concrete, measurable terms in listing his/her learning objectives under each of the following categories:
 - a) **Knowledge and Understanding**
 - b) **Skills**
3. The student will clearly state and describe in his brief reports regarding
 - a) **Learning Activities:** How will internship activities enable him/her to acquire the knowledge/understanding, and skills listed to be acquired by students (above)?
 - b) **On the job:** How internship activities will enable him/her to meet his/her learning objectives. Student should include *projects, research, report writing, conversations, etc., which student will do while working, relating them to what he/she intends to learn.*
 - c) **Teaching/Mentoring Activities:** How his/her technical knowledge can be applied at the site of the internship to create value through mentoring/help people learn new things.
 - d) **Off the job:** List of appropriate study material for reading, writing, method to keep contact with faculty supervisor, peer group discussion, field trips, observations, etc., he/she will make and carry out which will help him/her to meet his/her learning objectives.


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP

- e) **Evidences:** Student will describe in detail what other evidence he/she will provide to attached faculty mentor to document what was learnt (e.g. journal, analytic paper, project, descriptive paper, oral presentation, etc.) Deadline dates should be included.
 - f) **Evaluation:** The faculty or internship supervisor will provide a written evaluation, preferably in a tabular format, and by defining rubrics used for evaluation of internship.
 - g) **The Internship Job Description:** Student will describe about role and responsibilities while on his/her internship. (in as much detail as possible), about list of assigned /expected duties, project to be completed, deadlines, etc., and description of contribution expected by the organization/site of internship.
4. The internship will be defended by student during 5th semester in front of appropriate committee (including faculty/ internship supervisor) as per schedule notified by academic department. The concerned department will review the Internship-I rigorously to discourage low quality internship work and to avoid exit options as an escape route, rather than a genuine learning curve.


Dean - Academic
H.P. Technical University
Hamirpur - 177 001, HP