CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

Second Year (3rd and 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH

(N-2022 SCHEME)

Prepared by:-
Composite Curriculum Development Centre
Directorate of Technical Education,
Vocational & Industrial Training, Sundernagar (H.P.)

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SALIENT FEATURES

Programme	Three Year Diploma in Electrical and Electronics Engineering
Duration	Three years (Six Semesters)
Entry Qualification	As prescribed by H.P. Takniki Shiksha Board /AICTE
Intake	As approved by H.P. Takniki Shiksha Board
Pattern	Semester System
Curriculum for	Second Year Electrical and Electronics Engineering

PROGRAMME OUTCOMES (POs)

PO1	**Basic and Discipline specific knowledge:** Acquire knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
PO4	**Engineering Tools, Experimentation and Testing**: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements in the field of Electrical and Electronics Engineering.
PO5	**Engineering practices for society, sustainability and environment:** Describe and formulate appropriate technology in context of society, sustainability, environment and ethical practices.
PO6	**Project and Team Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
PO7	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO- 1	Apply the fundamental knowledge of mathematics, science, electrical and electronics engineering to analyse and solve the complex problems in electrical, electronics and allied interdisciplinary areas.
PSO - 2	Design, develop and implement electrical and electronics projects to meet the demands of industry and to provide effective solutions in the fields of Power Electronics, Power Systems and Electrical Machines alongwith current real time problems.
PSO - 3	Demonstrate the overall knowledge and contribute for the betterment of the society.

Definition of Credit:

1 Hr. Lecture (L) per week	1credit
1 Hr. Practical (P) per week	0.5credit
2 Hours Practical (P) per week	1credit

Course code and definition

Course code	Definitions
L	Lecture
T	Tutorial
DCS	Doubt Clearing Session
P	Practical
HS	Humanities & Social Sciences Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
AU	Audit Courses
SI	Summer Internship
PR	Project
SE	Seminar

List of Program Elective Courses 2nd Year [PE]

S.No.	Code No.	Course Title	Hours per week		Semester	Credits
			L	P		
1	EEEPE206-I	Industrial Instrumentation and Condition Monitoring	3	0	IV	3
2	EEEPE208-I	Industrial Instrumentation and Condition Monitoring Laboratory	0	2	IV	1
3	EEEPE206-I	Electrical Testing And Commissioning	3	0	IV	3
4	EEEPE208-I	Electrical Testing and Commissioning Laboratory	0	2	IV	1
5	EEEPE214-II	Process Control and Industrial Automation	4	0	IV	4
6	EEEPE216-II	Process Control and Industrial Automation Laboratory	0	2	IV	1
7	EEEPE214-II	Linear Integrated circuits	4	0	IV	4
8	EEEPE216-II	Linear Integrated circuits Laboratory	0	2	IV	1

Note: * EEEPE206,208 Opt anyone Program Elective subject (Electrical Engineering)
** EEEPE214,216 Opt anyone Program Elective subject (Electronics and Communication Engineering)

List of Audit Courses 2nd & 3rdYear [AU]

S.No.	Code No.	Course Title	Hours per week		Semester	Credits
			L	P		
1	AU202	Essence of Indian Knowledge and Traditions	2	0	IV	0

- AU202 Common with other Branches

STUDY AND EVALUATION SCHEME

THIRD SEMESTER

Sr. No	Category	Course Code	Course Title	Hours/Week			Total Hrs/ week	Credits	Evaluation Scheme								Total Marks
									Internal			External					
				L	P	DCS			L	P	Total	L	Hrs	P	Hrs	Total	
1	Program core course	EEEPC201	# Electrical Circuits	3	-	2	5	**3**	40	-	40	60	3	-	-	60	100
2	Program core course	EEEPC203	Electrical Circuits Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	60	100
3	Program core course	EEEPC205	## Digital Electronics	3		1	4	**3**	40	-	40	60	3	-	-	60	100
4	Program core course	EEEPC207	Digital Electronics Lab	-	2	1	3	**1**	-	40	40	-	-	60	3	60	100
5	Program core course	EEEPC209	#Electrical Motors and Transformers	3	-	2	5	**3**	40	-	40	60	3	-	-	60	100
6	Program core course	EEEPC211	Electrical Motors and Transformers Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	60	100
7	Program core course	EEEPC213	### Electronic Measurement and Instrumentation	3	-	1	4	**3**	40	-	40	60	3	-	-	60	100
8	Program core course	EEEPC215	Electronic Measurement and Instrumentation Lab	-	2	1	3	**1**	-	40	40	-	-	60	3	60	100
9	Program core course	EEEPC217	#### Electronics Devices and Circuits	3	-	1	4	**3**	40	-	40	60	3	-	-	60	100
10	Program core course	EEEPC219	Electronics Devices and Circuits Laboratory	-	2	1	2	**1**	-	40	40	-	-	60	3	60	100
11		----	Student Centered Activities	-	2	-	2	**0**	-	25	25	-	-	-	-	-	25
	Total Teaching Load			**15**	**12**	**10**	**36**										
	TOTAL							**20**	**200**	**225**	**425**	**300**	**15**	**300**	**15**	**600**	**1025**

 # Common with Diploma in Electrical Engineering
Common with Diploma in Electronics & Communication Engineering , Mechatronics
Common with Diploma in Electronics & Communication Engineering
Common with Diploma in Electronics & Communication Engineering, Electrical Engineering , Mechatronics

***The students shall undergo Internship-I at the end of 3rd semester (During semester break after board examinations of duration 04 weeks) which will be evaluated and reflected in study and evaluation scheme of 4th semester.**

STUDY AND EVALUATION SCHEME
FOURTH SEMESTER

Sr. No	Category	Course Code	Course Title	Hours/Week			Total Hrs/ week	Credits	Evaluation Scheme								Total Marks
									Internal			External					
				L	P	DCS			Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1	Program core course	EEEPC202	# Fundamentals of Power Electronics	3	-	1	4	**3**	40	-	40	60	3	-	-	60	**100**
2	Program core course	EEEPC204	Fundamentals of Power Electronics Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	60	**100**
3	Program Elective course	EEEPE206 Elective – I	Industrial Instrumentation and Condition Monitoring Or Electrical Testing and Commissioning	3	-	1	4	**3**	40	-	40	60	3	-	-	60	**100**
4	Program Elective course	EEEPE208 Elective – I Laboratory	Industrial Instrumentation and Condition Monitoring Or Electrical Testing and Commissioning Laboratory	-	2	-	2	**1**	-	40	40	-	-	60	3	60	**100**
5	Program core course	EEEPC210	# Induction, Synchronous and Special Electric Machines	3	-	1	4	**3**	40	-	40	60	3	-	-	60	**100**
6	Program core course	EEEPC212	Induction, Synchronous and Special Electric Machines Lab	-	2	-	2	**1**	-	40	40	-	-	60	3	60	**100**
7	Program Elective course	EEEPE214 Elective – II	## Linear Integrated Circuits or Process Control and Industrial Automation	4	-	-	4	**4**	40	-	40	60	3	-	-	60	**100**
8	Program Elective course	EEEPE216 Elective– II Laboratory	Linear Integrated Circuits or Process Control and Industrial Automation Laboratory	-	2	1	3	**1**	-	40	40	-	-	60	3	60	**100**
9	Minor Project	PR202	Minor Project	-	6	-	6	**3**	-	40	40	-	-	60	3	60	**100**
10	Mandatory Course	AU202	Essence of Indian Knowledge and Tradition	2	-	-	2	**0**	40	-	40	60	3	-	-	60	**100**
11		SI-1	Internship-I (4weeks) after III sem	-	-	-	0	**2**	-	40	40	-	-	60	3	60	**100**
12			Student Centered Activities	-	2	-	2	**0**	-	25	25	-	-	-	-	-	**25**
	Total Teaching Load			**15**	**16**	**4**	**35**										
	TOTAL							**22**	**200**	**265**	**465**	**300**	**15**	**360**	**18**	**660**	**1125**

 # Common with Diploma in Electrical Engineering

Common with Diploma in Electronics & Communication Engineering

*** The students shall undergo Internship-II at the end of 4th semester (During semester break after board examinations of duration 06 weeks) which will be evaluated and reflected in study and evaluation scheme of 5th semester.**

Detailed
Program Core Courses
of
Third Semester

Course Code	**:**	**EEEPC201**
Course Title	**:**	**ELECTRICAL CIRCUITS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:2)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course Objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electrical systems applying AC and DC circuit fundamentals.

Course Contents:

Unit – I Single Phase A.C Series Circuits

Generation of alternating voltage, Phasor representation of sinusoidal quantities R, L, C circuit elements its voltage and current response R-L, R-C, R-L-C combination of A.C series circuit, impedance, reactance, impedance triangle, Power factor, active power, reactive power, apparent power, power triangle and vector diagram, Resonance, Bandwidth, Quality factor and voltage magnification in series R-L, R-C, RL-C circuit

Unit – II Single Phase A.C Parallel Circuits

R-L, R-C and R-L-C parallel combination of A.C. circuits. Impedance, reactance, phasor diagram, impedance triangle R-L, R-C, R-L-C parallel A.C. circuits power factor, active power, apparent power, reactive power, power triangle. Resonance in parallel R-L, R-C, R-L-C circuit, Bandwidth, Quality factor and voltage magnification

Unit– III Three Phase Circuits

Phasor and complex representation of three phase supply, Phase sequence and polarity, Types of three-phase connections, Phase and line quantities in three phase star and delta system, Balanced and unbalanced load, neutral shift in unbalanced load, Three phase power, active, reactive and apparent power in star and delta system.

Unit– IV Network Reduction and Principles of Circuit Analysis

- Source transformation
- Star/delta and delta/star transformation
- Mesh Analysis
- Node Analysis

Unit– V Network Theorems

- Superposition theorem
- Thevenin's theorem
- Norton's theorem
- Maximum power transfer theorem
- Reciprocity theorem
- Duality in electric circuits

References:

1. Ashfaq Husain, Networks & Systems, Khanna Book Publishing, New Delhi.
2. Gupta, B.R and Singhal Vandana, Fundamentals of Electrical Network, S.Chand and Co., New Delhi,
3. Saxena, S.B Lal; Dasgupta, K Fundamentals of Electrical Engineering, Cambridge University Press Pvt. Ltd., New Delhi
4. Theraja, B. L. : Theraja, A. K;, A Text Book of Electrical Technology Vol-I, S. Chand & Co. Ramnagar,New Delhi
5. Sudhakar, A. ; Shyammohan, S. Palli; Circuit and network, McGraw Hill Education, New Delhi
6. Bell, David A., Electric Circuits, Oxford University Press New Delhi
7. Boylested, R.L., Introductory circuit Analysis, Wheeler, New Delhi
8. Mittle, V.N. ; Mittle, Arvind; Basic Electrical Engineering, McGraw Hill Education, Noida
9. Sivanandam, S.N, Electric Circuit Analysis, Vikas Publishing House Pvt. Ltd, Noida,
10. Salivahanan, S.; Pravin kumar, S; Circuit theory, Vikas Publishing House Pvt. Ltd, Noida

Course Outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Troubleshoot problems related to single phase A.C series circuits.
2. Troubleshoot problems related to single phase A.C parallel circuits.
3. Troubleshoot problems related to three phase circuits.
4. Use principles of circuit analysis to troubleshoot electric circuits.
5. Apply network theorems to troubleshoot electric circuits.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	12	10
2	12	10
3	14	15
4	12	10
5	14	15
Total	**64**	**60**

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 # Common with Diploma in Electrical Engineering

Course Code	**:**	**EEEPC203**
Course Title	**:**	**ELECTRICAL CIRCUITS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electrical systems applying AC and DC circuit fundamentals.

Practicals: (Any 12 practical to be performed)

1. Use dual trace oscilloscope to determine A.C voltage and current response in given R, L, C circuit.
2. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L series circuit. Draw phasor diagram.
3. Use voltmeter, ammeter to determine active, reactive and apparent power consumed in given R-C series circuit. Draw phasor diagram.
4. Use voltmeter, ammeter, wattmeter to determine active, reactive and apparent power consumed in given R-L-C series circuit. Draw phasor diagram.
5. Use variable frequency supply to create resonance in given series R-L-C circuit or by using variable inductor or variable capacitor.
6. Use voltmeter, ammeter, wattmeter to determine current, p.f. , active, reactive and apparent power in R-C parallel A.C. circuit.
7. Use voltmeter, ammeter, wattmeter, p.f meter to determine current, p.f., active, reactive and apparent power for given R-L-C parallel circuit with series connection of resistor and inductor in parallel with capacitor.
8. Use variable frequency supply create resonance in given parallel R-L-C circuit or by using variable inductor or capacitor.
9. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for balanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
10. Use voltmeter, ammeter, wattmeter, p.f meter to determine line and phase quantities of voltage and current for unbalanced three phase star and delta connected load and calculate active, reactive, and apparent power. Draw phasor diagram.
11. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying mesh analysis.
12. Use voltmeter, ammeter to determine current through the given branch of a electric network by applying node analysis.
13. Use voltmeter, ammeter to determine current through the given branch and voltage across the given element of circuit by applying superposition theorem.
14. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by

applying Thevenin's theorem

15. Use voltmeter, ammeter to determine equivalent circuit parameter in a given circuit by applying Norton's theorem
16. Use voltmeter, ammeter to determine load resistance for maximum power transfer for a given circuit by applying maximum power transfer theorem.

Practical outcomes:

1. Troubleshoot problems related to single phase A.C series circuits.
2. Troubleshoot problems related to single phase A.C parallel circuits.
3. Troubleshoot problems related to three phase circuits.
4. Use principles of circuit analysis to troubleshoot electric circuits.
5. Apply network theorems to troubleshoot electric circuits.

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Course Code	**:**	**EEEPC205**
Course Title	**:**	**Digital Electronics**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course Objective:

- To acquire the basic knowledge of digital logic gates and understanding, application of digital electronics circuits.
- It covers the building blocks of embedded systems used in today in smart devices.

Course Content:

1. **Number Systems & Boolean Algebra:** Introduction to different number systems – Binary, Octal, decimal, Hexadecimal. Conversion from one number system to another. Boolean variables – Rules and laws of Boolean algebra. De-Morgan's Theorem. Karnaugh Maps and their use for simplification of Boolean expressions.

2. **Logic Gates:** Logic Gates – AND, OR, NOT, NAND, NOR, XOR, XNOR: Symbolic representation and truth table. Implementation of Boolean expressions and Logic Functions using gates. Simplification of expressions.

3. **Combinational Logic Circuits** Arithmetic Circuits – Addition, Subtraction, 1's &2's Complement, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel and Series Adders Encoder, Decoder. Multiplexer – 2 to 1 MUX, 4 to 1 MUX, 8 to 1 MUX and their Applications, Demultiplexer – 1-2 DEMUX,1-4 DEMUX, 1- 8 DEMUX.

4. **Sequential Logic Circuits** Flip Flops – SR, JK, T, D, JK-MS, Triggering. Counters – 4bit Up – Down Counters, Asynchronous/ Ripple Counter, Decade Counter- Mod 3, Mod 7 Counter, Johnson Counter, Ring Counter. Registers – 4bit Shift Register: Serial In Serial Out, Serial In Parallel Out, Parallel In Serial Out, Parallel In Parallel Out.

5. **Memory Devices** Classification of Memories – RAM Organization, Address Lines and Memory Size, Static RAM, Bipolar RAM, Cell Dynamic RAM, D RAM, DDR RAM. Read only memory – ROM organization, Expanding memory, PROM, EPROM, EEPROM, Flash memory. Data Converters – Digital to Analog converters, Analog to Digital Converters.

References:

1. Digital principles & Applications Albert Paul Malvino & Donald P. Leach McGraw Hill Education; Eighth edition
2. Digital Electronics Roger L. Tokheim Macmillian McGraw-Hill Education (ISE Editions); International 2nd Revised edition

3. Digital Electronics – an introduction to theory and practice William H. Gothmann Prentice Hall India Learning Private Limited; 2 edition
4. Fundamentals of Logic Design Charles H. Roth Jr. Jaico Publishing House; First edition
5. Learning Private Limited, 2 edition
6. Digital Electronics R. Anand Khanna Publications, New Delhi (Edition 2018)

Course Outcomes:

1. Recall and order the logic gates and their circuits.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Recognition of various memory devices.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted(Hrs)**	**Marks Allotted**
1	12	12
2	14	14
3	12	10
4	14	14
5	12	10
Total	**64**	**60**

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Common with Diploma in Electronics & Communication Engineering, Mechatronics

Course Code	**:**	**EEEPC207**
Course Title	**:**	**DIGITAL ELECTRONICS LABORATORY**
Number of Credits	**:**	**1 (L:0, P:2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design and implementation of various logic gates, registers and associated circuits.

Practicals:

1. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR, XNOR using CMOS Logic gates and TTL Logic Gates.
2. Implement and realize Boolean Expressions with Logic Gates.
3. Implement Half Adder, Full Adder, Half Subtractor, Full subtractor using ICs.
4. Implement parallel and serial full-adder using ICs.
5. Design and development of Multiplexer and De-multiplexer using multiplexer ICs.
6. Verification of the function of SR, D, JK and T Flip Flops.
7. Design controlled shift registers.
8. Construct a Single digit Decade Counter (0-9) with 7 segment display.
9. To design a programmable Up-Down Counter with a 7-segment display.
10. Study of different memory ICs.
11. Study Digital to Analog and Analog to Digital Converters.
12. Simulate in Software (such as PSpice) an Analog to Digital Converter.

Practical Outcomes:

1. Implementation of logic gates and their circuits.
2. Verification of combinational and sequential circuits.
3. Implement of hardware circuit to test performance and application.
4. Comparison of various memory devices.

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Course Code	**:**	**EEEPC209**
Course Title	**:**	**ELECTRICAL MOTORS AND TRANSFORMERS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:2)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain electric motors and transformers.

Course contents

Unit – I: DC Generators

DC generator: construction, parts, materials and their functions. Principle of operation of DC generator: Fleming's right hand rule, schematic diagrams, e.m.f. equation of generator, armature reaction, commutation and Applications of DC generators.

Unit – II: D.C. Motors

DC motor: Types of DC motors. Fleming's left hand rule, Principle of operation , Back e.m.f. and its significance, Voltage equation of DC motor. Torque and Speed; Armature torque, Shaft torque, BHP, Brake test, losses, efficiency. DC motor starters: Necessity, two point and three point starters. Speed control of DC shunt and series motor: Flux and Armature control. Brushless DC Motor: Construction and working.

Unit– III: Single Phase Transformers

Types of transformers: Shell type and core type; Construction: Parts and functions, materials used for different parts: CRGO, CRNGO, HRGO, amorphous cores, Transformer: Principle of operation, EMF equation of transformer: Derivation, Voltage transformation ratio, Significance of transformer ratings Transformer No-load and on-load phasor diagram, Leakage reactance, Equivalent circuit of transformer: Equivalent resistance and reactance, Voltage regulation and Efficiency: Direct loading, OC/SC method, All day efficiency.

Unit– IV: Three Phase Transformers

Bank of three single phase transformers, Single unit of three phase transformer, Distribution and Power transformers, Construction, cooling, Three phase transformers connections as per IS:2026 (part IV)-1977, Three phase to two phase conversion (Scott Connection), Selection of transformer as per IS: 10028 (Part I)-1985, Criteria for selection of distribution transformer, and power transformer, Amorphous Core type Distribution Transformer, Specifications of three-phase distribution transformers as per IS:1180 (part I)-1989 Need of parallel operation of three phase transformer, Conditions for parallel operation, Polarity tests on mutually inductive coils and single phase transformers; Polarity test, Phasing out test on Three-phase transformer.

Unit V Special Purpose Transformers

Single phase and three phase auto transformers: Construction, working and applications.

Instrument Transformers: Construction, working and applications of Current transformer and Potentialtransformer.

Isolation transformer: Constructional Features and applications.

Single phase welding transformer: constructional features and applications. Pulse transformer: constructional features and applications, 'K' factor of transformers: overheating due to non-linear loads and harmonics.

References:

1. G.C. Garg & P.S. Bimbhra, Electrical Machines, Vol-I, II, Khanna Book Publishing House New Delhi
2. Mittle, V.N. and Mittle, Arvind., Basic Electrical Engineering, McGraw Hill Education, New Delhi
3. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New DelhiBhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi,
4. Mehta, V. K. and Mehta, Rohit, Principles of Electrical Machines, S. Chand and Co. Ltd., New Delhi
5. Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S. Chand and Co. Ltd., New Delhi,
6. Bandyopadhyay, M. N., Electrical Machines Theory and Practice, PHI Learning Pvt. Ltd., New Delhi
7. Murugesh Kumar, K., DC Machines and Transformers

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Maintain different types of DC generators.
2. Maintain different types of DC motors.
3. Maintain single phase transformer.
4. Maintain three phase transformers.
5. Maintain different types of special purpose transformers used in different applications.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	10	10
2	12	12
3	12	12
4	20	16
5	10	10
Total	**64**	**60**

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 # Common with Diploma in Electrical Engineering

Course Code	**:**	**EEEPC211**
Course Title	**:**	**ELECTRICAL MOTORS AND TRANSFORMERS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives

The aim of this course is to help the student to attain the following industry identified competency throughvarious teaching learning experiences:

- Use of electrical motors and transformers.

Practicals: (Any 12 practical to be performed)

1. Dismantle a DC machine.
2. Reverse the direction of rotation of the DC shunt motor.
3. Perform brake test on DC shunt motor.
4. Control the speed of DC shunt motor by different methods.
5. Control the speed of DC series motor by different methods.
6. Perform the brake test on DC series motor.
7. Check the functioning of single phase transformer.
8. Determine regulation and efficiency of single phase transformer by direct loading.
9. Perform open circuit and short circuit test on single phase transformer to determine equivalent circuitconstants, voltage regulation and efficiency.
10. Perform parallel operation of two single phase transformers to determine the load current sharing.
11. Perform parallel operation of two single phase transformers and determine the apparent and real power load sharing.
12. Perform polarity test on a single phase transformer whose polarity markings are masked.
13. Perform phasing out test on a three phase transformer whose phase markings are masked.
14. Connect the auto-transformer in step-up and step-down modes noting the input/output readings.
15. Check the functioning of the CT, PT and isolation transformer.
16. Test the pulse transformer.

Practical Outcomes:

1. Maintain different types of DC generators.
2. Maintain different types of DC motors.
3. Maintain single phase transformer.
4. Maintain three phase transformers.
5. Maintain different types of special purpose transformers used in different applications.

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Course Code	**:**	**EEEPC213**
Course Title	**:**	**ELECTRONIC MEASUREMENT AND INSTRUMENTATION**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course Objective:

- To know the necessity of different measuring instruments and their design principles.
- To understand the working principle of different measuring instruments and technical solutions to handle different errors.
- To learn the architecture and working principle of advanced measuring instrument and their applications.

Course Content:

1. **Basics of Measurements and Bridges:** Accuracy& precision, Resolution. Types of Errors. DC Bridges – Wheatstone and Kelvin Double Bridge. AC Bridges - Maxwell's Bridge, Hay's Bridge, Anderson Bridge, De-Sauty's Bridge.

2. **Potentiometer:** Basic DC slide wire Potentiometer. Crompton's DC Potentiometer, Applications of DC Potentiometer. AC Potentiometers, Applications of AC Potentiometers.

3. **Measuring Instruments:** Permanent Magnet Moving Coil Instruments (PMMC). Moving Iron type Instruments (MI). Electro Dynamo Type Instruments. Single Phase Energy Meter.

4. **Electronic Instruments:** Electronic Voltmeter and Digital Voltmeter. Electronic Multimeters. Q – Meter. Vector Impedance Meter.

5. **Oscilloscopes:** Cathode ray tube: construction, operation, screens, graticules. Vertical deflection system, Horizontal deflection system, Delay line, Measurement of frequency, time delay, phase angle and modulation index (trapezoidal method). Oscilloscope probe: Structure of 1:1 and 10:1 probe. Multiple Trace CRO.

6. **Transducers:** Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers: RTD, Thermocouple, Thermistor, LVDT, Strain Gauge Load Cell, Piezoelectric Transducers

REFERENCES / SUGGESTED LEARNING RESOURCES:

1. Electrical & Electronic Measurement & Instruments A.K. Sawhney Dhanpat Rai & Sons, India.
2. Electronic Instrument and Measurement Technique W.D. Cooper Prentice Hall International, India.

3. Electronic Measurement & Instrumentation J.G. Joshi Khanna Publishing House, Delhi.
4. Measurement systems application and design E.O. Doebelin and D. N. Manik The Mcgraw-Hill.
5. Electronic Measurements and Instrumentation Oliver and Cage the Mcgraw-Hill.
6. Basic Electrical Measurement M.B. Stout Prentice hall of India, India
7. Electronic Instrumentation H. S. Kalsi the Mcgraw-Hill
8. Electrical and Electronics Measurement and Instrumentation Prithwiraj Pukrait, Budhaditya Biswas, Santanu Das, ChiranjibKoleyTheMcgraw-Hill

Course Outcomes:

1. Understand fundamental of various electrical measurements.
2. Describe the measurement bridges, potentiometer and transducer.
3. Formulation of bridges and transducers.
4. Learning of measurement using various instruments under different setups.
5. Understanding of Oscilloscope and transducer.

Suggested Distribution of Marks (For Paper Setters and Students)

Topic No.	Time Allotted (Hrs)	Marks Allotted
1	10	9
2	10	9
3	10	9
4	10	9
5	12	12
6	12	12
Total	**64**	**60**

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Common with Diploma in Electronics & Communication Engineering

Course Code	**:**	**EEEPC215**
Course Title	**:**	**ELECTRONIC MEASUREMENT AND INSTRUMENTATION LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Calibration and measurement of various electrical quantities using different instruments.

Practicals:

1. Measure unknown inductance using following bridges (a) Anderson Bridge (b) Maxwell Bridge.
2. Measure Low resistance by Kelvin's Double Bridge.
3. Calibrate an ammeter using DC slide wire potentiometer.
4. Calibrate a voltmeter using Crompton potentiometer.
5. Measure low resistance by Crompton potentiometer.
6. Calibrate a single-phase energy meter by phantom loading.
7. Study the working of Q-meter and measure Q of coils.
8. Study working and applications of (i) C.R.O. (ii) Digital Storage C.R.O. & (iii) C.R.O. Probes.
9. Measurement of displacement with the help of LVDT.
10. Draw the characteristics of the following temperature transducers
    (a) RTD (Pt-100)
    (b) Thermistor.
11. Measurement of strain/force with the help of strain gauge load cell.

Practical Outcomes:

1. Measurement of various electrical quantities using different instruments.
2. Formulation of bridges and transducers.
3. Understanding and use of Oscilloscope and transducers.
4. Capable to calibrate the various measuring instruments.

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Course Code	**:**	**EEEPC217**
Course Title	**:**	**ELECTRONIC DEVICES AND CIRCUITS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course Objective:

- To introduce semiconductor devices BJT, FET, MOSFET and their characteristics, operation, circuit and applications.
- To introduce the concept of rectifiers, oscillators, amplifiers and various amplifier configurations.
- Description of SCR and family devices, their characteristics and applications.

Course Content:

Unit 1 – **Semiconductor and Diodes**

Definition, Extrinsic/Intrinsic, N-type & p-type
PN Junction Diode – Forward and Reverse Bias Characteristics
Zener Diode – Principle, characteristics, construction and working
Diode Rectifiers – Half Wave and Full Wave
Filters – C, LC and PI Filters

Unit 2 – **Bipolar Junction Transistor (BJT)**

NPN and PNP Transistor – Operation and characteristics
Common Base Configuration – characteristics and working
Common Emitter Configuration – characteristics and working
Common Collector Configuration – characteristics and working
High frequency model of BJT
Classification of amplifiers, negative feedback

Unit 3 – **Field Effect Transistors**

FET – Working Principle, Classification
MOSFET Small Signal model. N-Channel / P-Channel MOSFETs – characteristics, enhancement and depletion mode, MOSFET as a Switch
Common Source Amplifiers
Uni-Junction Transistor – equivalent circuit and operation

Unit 4 – **SCR DIAC & TRIAC**

SCR – Construction, operation, working, characteristics
DIAC - Construction, operation, working, characteristics
TRIAC - Construction, operation, working, characteristics
SCR and MOSFET as a Switch, DIAC as bidirectional switch
Comparison of SCR, DIAC, TRIAC, MOSFET

Unit 5 – **Amplifiers and Oscillators**

Feedback Amplifiers – Properties of negative Feedback, impact of feedback on different parameters. Basic Feedback Amplifier Topologies: Voltage Series, Voltage Shunt, Current Series, Current Shunt.

Oscillator – Basic Principles, Crystal Oscillator, Non-linear/ Pulse Oscillator.

References:

1. Analog Circuits by AK Mani, Khanna Publisher
2. Electronics Devices and Circuits by S. Salivahanan, N Suresh Kumar: Mc Graw Hill Education
3. Electronics Devices and Circuits Theory by Boyested & Nashelsky: Person Education India
4. Electronics Principles by Albert Malvino & David Bates: Tata Mc Graw Hill Publication
5. Electronics Devices and Circuits by Jacob Millman: Mc Graw Hill Education

Course Outcomes:

1. To understand various diodes and transistors used in analogue electronics
2. Recognition of amplifier configuration and cascading of amplifiers
3. Analyse small signal model of FET and MOSFET
4. Demonstration of rectifiers and concept of feedback in oscillators.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	12	12
2	14	12
3	12	12
4	14	12
5	12	12
Total	**64**	**60**

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Common with Diploma in Electronics & Communication Engineering, Electrical Engineering , Mechatronics

Course Code	**:**	**EEEPC219**
Course Title	**:**	**ELECTRONIC DEVICES AND CIRCUITS LABORATORY**
Number of Credits	**:**	**1 (L:0, P:2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Construction and working of various types of diodes and transistors together with their applications in rectifiers & amplifiers.

Practicals:

1. Construct the circuit and plot the VI characteristics of the PN Junction Diode, find the cut in voltage.
2. Construct the circuit and plot the characteristics of a Zener Diode. Find the breakdown voltage
3. Construct a Half Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
4. Construct a Full Wave Rectifier and obtain regulation characteristics – Without Filters and with Filters Compare the results
5. Construct a Bridge Rectifier and obtain regulation characteristics – Without Filters and with Filters
6. Obtain the characteristics of DIAC and TRIAC
7. Simulate half wave, full wave and bridge rectifier using simulation tool like PSpice/ ORCAD / Multisim.
8. Develop a simulation model for Voltage Series and Voltage Shunt Feedback Amplifiers

   Or

   Develop circuits for Voltage Series and Voltage Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.
9. Develop a simulation model for Current Series and Current Shunt Feedback Amplifiers
10. Develop circuits for Current Series and Current Shunt Feedback Amplifiers and obtain output plots. Compare the results with the simulation model.

Practical Outcomes:

1. To understand the characteristics of diode, zener diode, DIAC and TRIAC.
2. Verification of output waveforms of half wave and full wave bridge rectifier circuits.
3. Simulate half wave and full wave bridge rectifier circuits using suitable software.
4. Develop the circuit for all types of feedback amplifiers.

Course Code	:	**SI-I**
Course Title	:	**Internship-I**
Number of Credits	:	**2 (L: 0; T:0; P:0)**
Prerequisites	:	**-**
Course Category	:	**SI (Internship)**

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Guidelines

An internship of four weeks after 3rd semester during vacations should be undertaken in an industry/ Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/ Institutes/ Schemes. The assessment of internship will be carried out in 4thsemester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 4th semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor:40%

(b) The assessment criteria (External Assessment) by the institute is asfollows:

- Presentation : 60%
- Report : 20%
- Viva : 20%

Detailed
Program Core Courses
of
Fourth Semester

Course Code	**:**	**EEEPC202**
Course Title	**:**	**FUNDAMENTAL OF POWER ELECTRONICS**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

Course contents:

Unit – I Power Electronic Devices

Power electronic devices

Power transistor: construction, working principle, V-I characteristics and uses.

IGBT: Construction, working principle, V-I characteristics and uses.

Concept of single electron transistor (SET) - aspects of Nano- technology.

Unit – II Thyristor Family Devices

SCR: construction, two transistor analogy, types, working and characteristics. SCR mounting and cooling.

Types of Thyristors: SCR, LASCR, SCS, GTO, UJT, PUT, DIAC and TRIAC

Thyristor family devices: symbol, construction, operating principle and V-I characteristics.

Protection circuits: over-voltage, over-current, Snubber, Crowbar.

Unit– III Turn-on and Turn-off Methods of Thyristors

SCR Turn-On methods: High Voltage thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering. Gate trigger circuits – Resistance and Resistance-Capacitance circuits.

SCR triggering using UJT, PUT: Relaxation Oscillator and Synchronized UJT circuit.

Pulse transformer and opto-coupler based triggering. SCR Turn-Off methods: Class A-Series resonant commutation circuit, Class B-Shunt Resonant commutation circuit, Class C-Complimentary Symmetry commutation circuit, Class D –Auxiliary commutation, Class E- External pulse commutation, Class F- Line or natural commutation.

Unit– IV Phase Controlled Rectifiers

Phase control: firing angle, conduction angle.

Single phase half controlled, full controlled and midpoint controlled rectifier with R, RL load: Circuit diagram, working, input- output waveforms, equations for DC output and effect of freewheeling diode.

Different configurations of bridge controlled rectifiers: Full bridge, half bridge with common anode, common cathode, SCRs in one arm and diodes in another arm.

Unit– V Industrial Control Circuits

Applications: Burglar's alarm system, Battery charger using SCR, Emergency light system, Temperature controller using SCR and; Illumination control / fan speed control TRIAC, SMPS.

UPS: Offline and Online

SCR based AC and DC circuit breakers.

References:

1. Ramamoorty M., An Introduction to Thyristors and their applications, East-West Press Pvt. Ltd., New Delhi,
2. Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar, Thyristors: Theory and Applications, New Age International (P) ltd. Publishers, New Delhi
3. Bhattacharya, S.K., Fundamentals of Power Electronics, Vikas Publishing House Pvt. Ltd. Noida.
4. Jain & Alok , Power Electronics and its Applications, Penram International Publishing (India) Pvt. Ltd, Mumbai.
5. Rashid , Muhammad, Power Electronics Circuits Devices and Applications, Pearson Education India, Noida,
6. Singh, M. D. and Khanchandani, K.B., Power Electronics, Tata McGraw Hill Publishing Co. Ltd, New Delhi
7. Zbar, Paul B., Industrial Electronics: A Text –Lab Manual, McGraw Hill Publishing Co. Ltd., New Delhi
8. Grafham D.R., SCR Manual, General Electric Co.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student monstrates the following industry oriented COs associated with the above mentioned competency:

1. Select power electronic devices for specific applications.
2. Maintain the performance of Thyristors.
3. Troubleshoot turn-on and turn-off circuits of Thyristors.
4. Maintain phase controlled rectifiers.
5. Maintain industrial control circuits.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	10	10
2	14	13
3	16	15
4	14	12
5	10	10
Total	**64**	**60**

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 # Common with Diploma in Electrical Engineering

Course Code	**:**	**EEEPC204**
Course Title	**:**	**FUNDAMENTAL OF POWER ELECTRONICS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

Practicals: (Any 12 practical to be performed)

1. Test the proper functioning of power transistor.
2. Test the proper functioning of IGBT.
3. Test the proper functioning of DIAC to determine the break over voltage.
4. Determine the latching current and holding current using V-I characteristics of SCR.
5. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
6. Test the effect of variation of R, C in UJT triggering technique.
7. Perform the operation of Class – A, B, C, turn off circuits.
8. Perform the operation of Class –D, E, F turn off circuits.
9. Use CRO to observe the output waveform of half wave controlled rectifier with resistive load and determine the load voltage.
10. Draw the output waveform of Full wave controlled rectifier with R load, RL load, free wheeling diode and determine the load voltage.
11. Determine the firing angle using DIAC and TRIAC phase controlled circuit on output power under different loads such as lamp, motor or heater
12. Simulate above firing angle control on SCILAB software
13. Test the performance of given SMPS, UPS.
14. Troubleshoot the Burglar's alarm, Emergency light system, Speed control system, Temperature control system.

Practical outcomes:

1. Select power electronic devices for specific applications.
2. Maintain the performance of Thyristors.
3. Troubleshoot turn-on and turn-off circuits of Thyristors.
4. Maintain phase controlled rectifiers.
5. Maintain industrial control circuits.

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Course Code	**:**	**EEEPC210**
Course Title	**:**	**INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

Course contents:

Unit – I Three Phase Induction Motor

Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip, Constructional details of 3 phase induction motors: Squirrel cage induction motor and Slip ring induction motor. Rotor quantities: frequency, induced emf, power factor at starting and running condition. Characteristics of torque versus slip (speed), Torques: starting, full load and maximum with relations among them, Induction motor as a generalized transformer with phasor diagram, Four quadrant operation, Power flow diagram Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance and soft starters.

Speed control methods: stator voltage, pole changing, rotor resistance and VVVF.

Motor selection for different applications as per the load torque-speed requirements,

Maintenance of three phase induction motors.

Unit – II Single phase induction motors

Double field revolving theory, principle of making these motors self-start, Construction and working: Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor, hysteresis motor, Torque - speed characteristics for all of the above motors, motor selection for different applications as per the load torque-speed requirements, Maintenance of single phase induction motors.

Unit– III Three phase Alternators

Principle of working, moving and stationary armatures, Constructional details: parts and their functions, rotor constructions. Windings: Single and Double layer. E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor, Alternator loading: Factors affecting the terminal voltage of alternator; Armature resistance and leakage reactance drops, Armature reaction at various power factors and synchronous impedance. Voltage regulation: direct loading and synchronous impedance methods, Maintenance of alternators.

Unit– IV Synchronous motors

Principle of working / operation, significance of load angle, Torques: starting torque,

running torque, pull in torque, pull out torque, Synchronous motor on load with constant excitation (numerical), effect of excitation at constant load (numerical), V-Curves and Inverted V-Curves, Hunting and Phase swinging, Methods of Starting of Synchronous Motor, Losses in synchronous motors and efficiency (no numerical), Applications areas.

Unit– V Fractional horse power (FHP) Motors

Construction and working: Synchronous Reluctance Motor, Switched Reluctance Motor, BLDC, Permanent Magnet Synchronous Motors, stepper motors, AC and DC servomotors, Torque speed characteristics of above motors, Applications of above motors.

References:

1. P.S. Bimbhra, Electric Machines, Khanna Book Publishing Co., New Delhi
2. Mittle, V.N. and Mittle, Arvind, Basic Electrical Engineering, McGraw Hill Education New Delhi
3. Kothari, D. P. and Nagrath, I. J., Electrical Machines, McGraw Hill Education. New Delhi
4. Bhattacharya, S. K., Electrical Machines, McGraw Hill Education, New Delhi
5. Theraja, B.L., Electrical Technology Vol-II (AC and DC machines), S.Chand and Co. Ltd., New Delhi
6. Sen, S. K., Special Purpose Electrical Machines, Khanna Publishers, New Delhi
7. Janardanan E. G, Special Electrical Machines, Prentice Hall India, New Delhi

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Maintain three phase induction motor used in different applications.
2. Maintain single phase induction motor used in different applications.
3. Maintain three phase alternators used in different applications.
4. Maintain synchronous motors used in different applications.
5. Maintain FHP motors used in different applications.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted(Hrs)**	**Marks Allotted**
1	16	15
2	12	10
3	16	15
4	12	12
5	8	8
Total	**64**	**60**

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 # Common with Diploma in Electrical Engineering

Course Code	**:**	**EEEPC212**
Course Title	**:**	**INDUCTION, SYNCHRONOUS AND SPECIAL ELECTRIC MACHINES LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PC**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

Practicals: (Any 12 practical to be performed)

1. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor.
2. Connect and run the three phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two).
3. Perform the direct load test on the three phase squirrel cage induction motor and plot the i) efficiency versus output, ii) power factor versus output, iii) power factor versus motor current and iv) torque – slip/speed characteristics.
4. Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage induction motor and determine the equivalent circuit parameters.
5. Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage induction motor and plot the Circle diagram.
6. Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto-transformer, ii) VVVF.
7. Measure the open circuit voltage ratio of the three phase slip ring induction motor.
8. Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.
9. Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.
10. Determine the regulation and efficiency of the given three phase alternator from OC and SC tests (Synchronous impedance method)
11. Conduct the test on load or no load to plot the ‘V’ curves and inverted ‘V’ curves (at no-load) of 3-f synchronous motor.
12. Dismantling and reassembling of single phase motors used for ceiling fans, universal motor for mixer.
13. Control the speed and reverse the direction of stepper motor.
14. Control the speed and reverse the direction of the AC servo motor.
15. Control the speed and reverse the direction of the DC servo motor.

Practical outcomes:

1. Maintain three phase induction motor used in different applications.
2. Maintain single phase induction motor used in different applications.
3. Maintain three phase alternators used in different applications.
4. Maintain synchronous motors used in different applications.

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Course Code	**:**	**PR202**
Course Title	**:**	**MINOR PROJECT**
Number of Credits	**:**	**03 (L: 0, T: 0, P: 6)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PR**

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries.

Course Content: List of Suggested Ideas for Minor Project

1. Various types of Cables available in the market, their current rating/ specifications, different makes/ manufacturing companies (minimum three), comparison of cost between different makes.
2. Various types of domestic/ wiring components such as switches, sockets, holders, conduits, battens, fixtures etc. : their specifications, different makes or manufacturing companies(minimum three), comparison of cost between different makes.
3. Various types of protective devices used in domestic and industrial wiring such as MCBs, ELCB/RCCB, fuses etc. their specifications, make (minimum three), and comparison of cost between different makes.
4. Various types of electric lamps (luminaries)available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
5. Various types of Electrical Appliances (domestic and commercial) available in the market, their specifications, different makes or manufacturing companies (minimum three), comparison of cost between different makes.
6. Students practice in minor repair works in the Institution and campus.
7. Regulated power supply
8. Timers using 555 and other oscillators
9. Touch plate switches– transistorized or 555 based
10. Doorbell/cordless bell
11. Clapping switch and IR switch
12. Blinkers
13. Sirens and hooters
14. Single hand AM or FM
15. Electronic toy gun, walker, blinkers
16. Electronic dice

NOTE :- The students of the class may be divided into groups (3 to 5 students per group) and work may be assigned to each group as per their interest.

The components of evaluation will include the following:

Marks Weightage

a) Punctuality/Attendance	20%
b) Initiative in learning new thing	10%
c) Performance as Individual in the Team	10%
d) Project Report	40%
e) Viva	20%

Course Outcomes:

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the student will be able to comprehend concepts, principles and practices taught in the classroom and their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work.

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Course Code	**:**	**SI-II**
Course Title	**:**	**Internship-II**
Number of Credits (Teaching Load)	**:**	**3 (L: 0; T:0; P:0)**
Prerequisites	**:**	**-**
Course Category	**:**	**SI (Internship)**

Guidelines

An internship of Six weeks after 4thsemester during vacations should be undertaken by the students in relevant Industry. The objective of this mandatory internship is to expose the students to the real world of work and get experience with the latest tools, best practices, work & culture, etiquettes and ethics followed in modern industries. The assessment of internship will be carried out in 5th semester. The faculty members must visit the internship site during the course of internship to monitor the progress of the students.

Evaluation Criteria

The internal assessment of internship is to be carried out by the Industry/ Organization where the students have undergone the internship. The internal assessment done by the industry/ organization may be rationalized by the Department, if needed. The external assessment is to be done at the Institute. The department shall finalize external assessment within a month of the beginning of the 5th semester. The students have to prepare a daily diary of their internship period and the same has to be submitted at the institute after completion of the internship. The students have also to present the experience gained during internship in a seminar for the purpose of external evaluation.

(a) The assessment criteria (Internal Assessment) by the industry/ organization where the students have undergone the internship is as follows:

- Attendance and general behavior : 20%
- Daily diary maintenance : 20%
- Initiative and participative attitude during internship : 20%
- Performance in the assigned activities by the industrial supervisor : 40%

(b) The assessment criteria (External Assessment) by the institute is as follows:

- Presentation :60%
- Report:20%
- Viva :20%

Annexure-I

for
Program Elective Courses

Course Code	:	**EEEPE206**
Course Title	:	**INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING**
Number of Credits	:	**3 (L: 3, T: 0, P: 0, DCS:1)**
Prerequisites	:	**NIL**
Course Category	:	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competencythrough various teaching learning experiences:

- Use instrumentation equipment for condition monitoring and control.

Course contents:

Unit – I Fundamentals of instrumentation

Basic purpose of instrumentation. Basic block diagram (transduction, signal conditioning, signal presentation) and their function. Construction, working and application of switching devices- Push button, limit switch, float switch, pressure switch, thermostat, electromagnetic relay.

Unit – II Transducers

Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices pry. And sec. transducers Advantages of electric transducers Required characteristics of transducers. Factors affecting the choice of transducers Construction and principle of resistive transducer-Potentiometer –variac and strain gauges -No derivation. Only definition and formula for gauge factor Types of strain gauges like unbonded, bonded and semiconductor. Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications. Construction, principle and applications of transducers – Piezo-Electric transducer, photo- conductive cells, photo voltaic cells.

Unit– III Measurement of Non-Electrical Quantities

Temperature measurement - Construction and Working of RTD, Thermistor and Thermocou-ple, radiation pyrometer, technical specifications and ranges.

Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit. Construction and Working of Speed Measurement by contacting and non-Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pick- up and Stroboscope. Construction and Working of Vibration measurement by accelerometer-LVDT accelerometer, Piezo electric type. Construction and Working of Flow measurement by electromagnetic and Turbine Flow me ter. Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods.

Construction and Working of Thickness measurement by resistive, inductive, capacitive, ul-trasonic and Nuclear methods.

Unit– IV Signal Conditioning

Basic Concept of signal conditioning System. Draw pin configuration of IC 741.
Define Ideal OP-AMPand Electrical Characteristics of OP-AMP. Different arameters of op-amp:-Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain band-width. Output, short circuit current. Use of op-amp as inverting, non- inverting mode, adder, subtractor, and Working of Differential amplifier and instrumentation amplifier. Filters: Types of RC filters and frequency response -no derivation.Sample and hold circuits - operation and its application.

Unit– V Data Acquisition System

Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplex-er, converter and recorder Draw Single Channel and Multi-channel DAS- Block diagram only. Difference between Signal Channel and Multi-Channel DAS. Data conversion- Construction and Working of Analog to digital conversion- successive ap-proximation method, ramp type method. Digital to Analog conversion- Construction and Working of binary weighted resistance method. Concept and methods of data transmission of electrical and electronic transmission. Construction and principle of telemetry system and its type - Electrical telemetering system- Digital display device- operation and its application of seven segment display, dot matrix dis- play and concept of 3½, 4½ digits, LED and LCD applications

Unit– VI Condition Monitoring and Diagnostic Analysis

Definition of condition monitoring Insulation deterioration Mechanism- factors affecting occurrence and rate of deterioration,types of stresses responsible for deterioration Different tests on transformer, their purpose, and the necessary condition of machine.Tests on Circuit breaker, purpose and required condition of machine Tests on CT, purpose, item to be tested and required condition of machine. Power factor, capacitance /tan delta test Insulation and Polarization index, DC winding resistance test, Turns Ratio test Tools and equipment used in Condition monitoring.

References:

1. Sawhney, A.K. Electric and Electronic Measurement and instrumentation, Dhanpat Rai and Co.Author, Nineteenth revised edition 2011 reprint, 2014**,** ISBN:10: 8177001000
2. Rangan, C.S. G.R.Sharma. andV.S.V.Mani, Instrumentation devices and system, Pen ram Interna-tional *Publishing* India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3. Mehta, V.K. Electronics and instrumentation, Third edition-S.Chand and company Pvt Ltd Re-print, 2010, ISBN:81-219-2729-3
4. Singh, S.K. Industrial instrumentation and control, Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.

5. J.G. Joshi, Electronic Measurement and Instrumentation, Khanna Publishing House, New Delhi(ISBN: 978-93-86173-621)

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associatedwith the above mentioned competency:

1. Select relevant instruments used for measuring electrical and non-electrical quantities.
2. Select relevant transducers/sensors for various applications.
3. Use relevant instruments for measuring non-electrical quantities.
4. Check the signal conditioning and telemetry system for their proper functioning.
5. Use data acquisition systems in various applications.
6. Undertake condition monitoring for diagnostic analysis of electrical equipment

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	08	04
2	10	08
3	12	14
4	12	14
5	12	14
6	10	06
Total	**64**	**60**

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Course Code	**:**	**EEEPE208**
Course Title	**:**	**INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING LABORATORY**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competencythrough various teaching learning experiences:

- Use instrumentation equipment for condition monitoring and control.

Practicals:

1. Identify different switches used in instrumentation system.
2. Measure linear displacement by L.V.D.T.
3. Measure the strain with the help of strain gauge
4. Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.
5. Use Thermocouple to control the temperature of a furnace/machine.
6. Measure pressure using pressure sensor kit.
7. Measure angular speed using stroboscope and tachometer.
8. Measure the flow using flow meter.
9. Use op-amp as inverter, non-inverting mode, adder, differentiator and integrator.
10. Convert digital data into analog data by using analog to digital converters and analog datainto digital data by digital to analog converter.
11. Visit to testing center of electrical testing lab for tan delta and diagnostic tests and determine polarization index
12. Prepare a Report on various tools and equipment used for condition monitoring of electricalmachines.

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associatedwith the above mentioned competency:

a) Select relevant instruments used for measuring electrical and non-electrical quantities.

b) Select relevant transducers/sensors for various applications.

c) Use relevant instruments for measuring non-electrical quantities.

d) Check the signal conditioning and telemetry system for their proper functioning.
e) Use data acquisition systems in various applications.
f) Undertake condition monitoring for diagnostic analysis of electrical equipment.

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Course Code	**:**	**EEEPE206**
Course Title	**:**	**ELECTRICAL TESTING AND COMMISIONING**
Number of Credits	**:**	**3 (L:3, T:0, P:0, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment.

Course contents:

Unit – I Electrical Safety and Insulation

Do's and don'ts regarding safety in domestic electrical appliances as well for substation/power station operators, Electrical safety in industry/power stations/ substations at the time of peration/ control/maintenance. Fire detection alarm, fire-fighting equipments Factors affecting life of insulating materials, classifications of insulating materials as per IS:1271-1958 Measuring insulation resistance by different methods such as i) Polarization, ii) Dielectric, absorption, iii) Megger and to predict the condition of insulation Reconditioning of insulation, Insulating oil – properties of insulating oil, causes of deterioration of oil, testing of transformer oil as per IS 1866-1961

Unit – II Installation and Erection

Concept of foundation for installation of machinery. Requirements of foundation for static and rotating electrical machinery. Concept of leveling and aligning Procedure for leveling and aligning alignment of direct coupled drive, effects of mis-alignment Installation of transformer as per I.S.-1886-1967 and procedure of installation of transformer, Requirements of installation of pole mounted transformer Requirements of installation of rotating electrical machines as per I.S. 900 – 1965 Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

Unit– III Testing and Commissioning

Concept of testing, Objectives of testing. Roles of I.S.S. in testing of electrical equipment, Types of tests and concepts, Routine tests, type tests, supplementary test, special tests, Methods of testing – Direct/Indirect/Regenerative testing. Tolerances for the various items for equipment – transformer, induction motor, dc motor, synchronous machines Commissioning, Tests before Commissioning for transformer, induction motor, alternator Testing of transformer as per I.S.1886- 1967 and I.S.2026- 1962 Testing of three-phase Induction motor as per I.S.325 – 1970. Testing of single-phase induction motor as per I.S.990-1965. Testing of synchronous machines as per ISS Testing of D.C. machines

Unit– IV Troubleshooting Plans

Internal and external causes for failure / abnormal operation of equipment. List of mechanical faults, electrical faults and magnetic faults in the electrical equipment, remedies, applications Use of tools like bearing puller filler gauges, dial indicator, spirit level, megger, earth tester,and

growler. Common troubles in electrical equipments and machines. Preparation of trouble shooting charts for D.C. Machines, AC Machines and transformers.

Unit– V Maintenance

Concept of maintenance, types of maintenance, Routine, preventive and breakdown maintenance. Causes of failure of electrical machines Preventive maintenance-procedure or developing maintenance schedules for electrical machines. Factors affecting preventive maintenance schedules, Concept of TPM, Pillars of TPM Identification of different types of faults developed such as mechanical/ electrical/ magnetic faults Maintenance schedules of the following as per I.S.S.

a) Distribution transformer as per I.S.1886-1967
b) Single phase and three phase Induction motors as per I.S.900-1965.
c) Batteries

References:

1. Deshpande.M. V. PHI Learning Pvt. Ltd., 2010, Design and Testing of Electrical Machines ISBN No 8120336453, 9788120336452.
2. Rao, B V S Asia Club House, First Reprint, 2011, Operation and Maintenance of Electrical Equipment Vol-I, ISBN No 8185099022
3. Rosenberg. Mc GRAW-HILL, 1st Edition, May 2003, Maintenance and Repairs, ISBN No 9780071396035
4. Sharotri, S.K. Glencoe/ Mcgraw- Hill; 2ndEdition , June 1969; Preventive Maintenance of Electrical Apparatus, ISBN No 10: 007030839X 13: 978-0070308398

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented Cos associated with the above mentioned competency:

1. Follow safety procedures with respect to earthing and insulation of electrical equipment
2. Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers
3. Test and commission electrical equipment in accordance with IS codes
4. Make plans for troubleshooting electrical machines.
5. Undertake regular preventive and breakdown maintenance.

SUGGESTED DISTRIBUTION OF MARKS		
Topic No.	**Time Allotted (Hrs)**	**Marks Allotted**
1	12	12
2	12	10
3	16	16
4	12	10
5	12	12
Total	**64**	**60**

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Course Code	**:**	**EEEPE208**
Course Title	**:**	**ELECTRICAL TESTING AND COMMISIONING LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment.

Practicals:

1. Determine breakdown strength of transformer oil.
2. Perform insulation resistance test on any one motor/transformer.
3. Prepare trouble shooting charts for electrical machines such as Transformer, D.C. machines, Induction motor, and Synchronous machines
4. Measure impedance voltage and load losses of three-phase transformer.
5. Find regulation and efficiency of single-phase transformer by direct loading and back-to-back connection method and compare the results.
6. Determine efficiency of D.C. machine by Swinburne's test.
7. Determine efficiency of D.C. machine by Hopkinson's test.
8. Perform reduced voltage running up test on three-phase Induction motor as per I.S.325 -1967.
9. Measure no load losses and no load current of a transformer as per IS.
10. Perform no load test on single phase Induction motor for the measurements of no load current, power input, and speed at rated voltage as per I.S.
11. Perform temperature rise test on single-phase transformer.
12. Find efficiency of M.G. set

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Follow safety procedures with respect to earthing and insulation of electrical equipment
2. Select proper tools, equipment, for installation, testing, maintenance of electrical machines and transformers
3. Test and commission electrical equipment in accordance with IS codes
4. Make plans for troubleshooting electrical machines
5. Undertake regular preventive and breakdown maintenance.

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Course Code	**:**	**EEEPE214**
Course Title	**:**	**LINEAR INTEGRATED CIRCUITS**
Number of Credits	**:**	**4 (L:4, T:0, P:0, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course Objective:

- To introduce the basic building blocks of linear integrated circuits.
- Illustration of Linear integrated circuit in the modern electronic devices.
- Recognize and make use of the DC & AC limitations of OP-AMPS.
- To introduce the theory and applications of analog multipliers and PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.

Course Contents

1. **IC Fabrication and Circuit Configuration for Linear IC**: Advantages of ICs over discrete components – Manufacturing process of monolithic IC's, Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors, Monolithic Capacitors – Inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

2. **Applications of Operational Amplifiers**: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

3. **Analog Multiplier and PLL**: Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

4. **Analog to digital and digital to analog converters**: Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, high speed sample-and-hold circuits, A/D Converters specifications - Flash type
   - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to- Time Conversion - Over-sampling A/D Converters.

5. **Waveform generators and special function ICs:** Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjust- able voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched

capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

Suggested text/reference books:

1. Design with operational amplifiers and analog integrated circuits, 3rd Edition Sergio Franco Tata McGraw-Hill, 2007
2. Linear Integrated Circuits, D.Roy Choudhry, Shail Jain New Age International Pvt. Ltd
3. System design using Integrated Circuits B.S. Sonde New Age Pub, 2nd Edition, 2001
4. Analysis and Design of Analog Integrated Circuits Gray and Meyer Wiley International, 2005.
5. OP-AMP and Linear ICs Ramakant A.Gayakwad Prentice Hall / Pearson Education, 4th Edition, 2001
6. Operational Amplifier and Linear Integrated Circuits K Lal Kishore , Pearson Education, 2006 .

Course Outcomes:

1. Description and Understanding of IC Fabrication and Circuit Configuration for Linear IC.
2. Design and analysis of operation amplifier application.
3. Generalizations of the ADC and DAC operation and parameters.
4. Understanding of Waveform generators and special function ICs.

Suggested Distribution of Marks

Topic /Unit	Time (In Hrs.)	%age Distribution of Marks
1	12	12
2	12	12
3	12	12
4	14	12
5	14	12
Total	**64**	**60**

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Common with Diploma in Electronics & Communication Engineering

Course Code	**:**	**EEEPE216**
Course Title	**:**	**LINEAR INTEGRATED CIRCUITS LABORATORY**
Number of Credits	**:**	**1 (L:0, T:0, P:2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Understanding the operation and applications of OP-AMP, Timer IC and PLL ICs .

Practicals:

1. Operational Amplifiers (IC741)-Characteristics and Application.
2. Waveform Generation using Op-Amp (IC741).
3. Applications of Timer IC555.
4. Design of Active filters.
5. Study and application of PLL IC's.
6. Design of binary adder and subtractor.
7. Design of counters.
8. Study of multiplexer and demultiplexer /decoders.
9. Implementation of combinational logic circuits
10. Study of DAC and ADC.
11. Op-Amp voltage Regulator- IC 723

Practical Outcomes:

1. Fabrication and applications of Linear ICs.
2. Design of various combinational logic circuits.
3. Design of various filter circuits.
4. Understanding of ADC and DAC operation.

Course Code	**:**	**EEEPE214**
Course Title	**:**	**Process Control and Industrial Automation**
Number of Credits	**:**	**4 (L:4, T:0, P:0, DCS:0)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Description and Illustration of different control generation methods.
- Identification & understanding of architecture of Industrial automation.
- Interpretation of PLC and their application in hydraulic & Pneumatic system.

Course Content:

Unit I - Basics of process control
Control Generation
Introduction to Automatic Control
P-I-D Control
Feed forward Control Ratio Control
The branching operations based on conditions expression

Unit II - Overview and Architecture of Industrial automation Systems
Measurement Systems Characteristics
Data Acquisition Systems

Unit III Sequential control and PLC
Introduction to Sequence Control, PLC , RLL
PLC Hardware Environment

Unit IV Industrial control application
Hydraulic Control Systems
Pneumatic Control Systems
Energy Savings with Variable Speed Drives
Introduction To CNC Machines

Course outcomes:

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Analysis and reorganization of data acquisition and architecture of an automated industrial setup.
2. Demonstration and formulation of PLC hardware and programing.
3. Understanding of hydraulic and pneumatic control system
4. Introduction to electric derives and CNC machines.

REFERENCES / SUGGESTED LEARNING RESOURCES*:*

S. No.	Title of Book	Author	Publication
1.	Industrial Instrumentation, Control and Automation	S. Mukhopadhyay, S. Sen and A. K. Deb	Jaico Publishing House, 2013ISBN : 978-8184954098
2.	Electric Motor Drives, Mod elling, Analysis and Control	R. Krishnan	Prentice Hall India, 2002 ISBN : 978-0130910141

Suggested Distribution of Marks

Topic /Unit	Time (In Hrs.)	%age Distribution of Marks
1	20	20
2	16	15
3	12	10
4	16	15
Total	**64**	**60**

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Course Code	**:**	**EEEPE216**
Course Title	**:**	**Process Control and Industrial Automation Lab**
Number of Credits	**:**	**1 (L: 0, T: 0, P: 2, DCS:1)**
Prerequisites	**:**	**NIL**
Course Category	**:**	**PE**

Course objectives:
The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Industrial Automation Systems.

Course Content:

1. Develop a data acquisition system using Arduino.
2. Temperature control system using PID
3. Level control system based on error feedback
4. PLC programming using Relay ladder Logic for AND, OR, XOR and NOR gate
5. PLC, RLL programming using CASCADE method
6. PLC timer, counter, registers, and analog input/output functions
7. Variable Speed drive of an induction motor.
8. PLC/ microcontroller-based computer numerical control machine job completion.

Practical Outcomes (Pros).

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessedin the student for the attainment of the competency.

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Annexure-II

for

Audit Courses

Course Code	:	**AU202**
Course Title	:	**Essence of Indian Knowledge & Tradition**
Number of Credits	:	**0 (L: 2, P:0, DCS:0)**
Prerequisites	:	**-**
Course Category	:	**AU (Audit Course)**

Course Learning Objectives

The objective of this course is to expose the students with the concepts of Indian traditional knowledge and to make them appreciate the importance of the roots of indigenous knowledge system.

Course Outcomes

After completing this course the students will be able to:

CO-1. Identify the concept of Indian Knowledge System (IKS).

CO-2. Understand the need and importance of protecting traditional knowledge.

CO-3. Compare the Indian traditional knowledge and modern science.

CO-4. Understand the use of Yoga in stress management, mental health, mindfulness, healthy eating, weight loss and quality sleep.

CO-5. Aware of the general knowledge of Himachal Pradesh.

Unit 1 Indian Knowledge System (IKS):----------25%

- Introduction and Function of Indian Knowledge System(IKS).
- The Basic Structure of Indian Knowledge System(IKS) (only Introduction)

1. The 4 Vedas, Namly ऋग्वेद (Rigveda) ,यजुर्वेद (Yajurveda),सामवेद (Samaveda) ,अथर्ववेद (Atharvaveda) .
2. The 4 UpVedas, Namely आयुर्वेद (Ayurveda (health-care)), धनुर्वेद (Dhanurveda (archery)), गंधर्ववेद (Gandharva-veda (dance, music etc.)) and स्थापत्यवेद (Sthapatyaveda (architecture)).
3. The 6 Vedagangs ,namely Shiksha (शिक्षा), Kalpa (कल्प), Vykaraṇa (व्याकरण), Chhandas छंदस्), Nirukta (निरुक्त), and Jyotisha(ज्योतिष).
4. Itihasa (इतिहास) (Ramayana रामायण and Mahabharata महाभारत) and Purana

पुराण (Vishnupurana विष्णुपुराण , Bhagavata Purana (भागवत पुराण) etc.)

5. Dharmashatraधर्मशास्त्र (Manusmriti मनुस्मृति, Yajnavalkya-smriti याज्ञवल्क्य स्मृति, etc.).
6. Darshan दर्शन (आस्तिक तथा नास्तिक).
7. Nyaya न्याय (Logic तर्कशास्त्र and Epistemology ज्ञानमीमांसा).

Unit 2 : Modern Science ---------- **20% Marks**

- Modern science: Introduction, Characteristics, importance and Example
- Difference between modern Science and Indian knowledge system
- Role of IKS in modern science

Unit 3 : Traditional knowledge ---------- **15% Marks**

- Traditional knowledge: Definition, nature, characteristics, scope and importance
- Indigenous Knowledge (IK): characteristics
- Traditional knowledge vis-a-vis Indigenous knowledge
- Traditional knowledge Vs western knowledge
- The need for protecting traditional knowledge

Unit 4 : Yoga and Holistic Health Care ---------- **25% Marks**

- Yoga: Meaning and Importance of Yoga
- Yoga and physical health, Yoga and psychological health, Yoga and intellectual health, Yogaand spiritual health, Yoga and social approach.
- Introduction to Ashtanga Yoga, Yogic Kriyas (Shat Karma)
- Pranayama and its types; Active lifestyle and stress management through Yoga
- Physical Fitness, Health and wellness: Meaning and Importance of Wellness,
- Components of Wellness, Health and physical Fitness;
- Traditional sports & Regional Games for promoting wellness:
- Leadership through Physical Activity and Sports; Introduction to First Aid.

Unit 5 : Himachal Pradesh: A Basic Information ---------- **15% Marks**

- History, Culture, Heritage/ Tradition, Customs & Manners,
- Regional Knowledge, Geographical Features, Constitutional History
- Tourism Place & Scope

- Festivals and Fairs

Suggested Text/ Reference Books

1. Cultural Heritage of India-Course Material by V. Sivaramakrishna Bharatiya,Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Modern Physics and Vedant by Swami Jitatmanand Bharatiya, Vidya Bhavan
3. The wave of Life by Fritz of Capra
4. Tao of Physics Fritz of Capra
5. Tarkasangraha of Annam Bhatta, International by V N Jha, Chinmay Foundation, Velliarnad, Ernakulam
6. Science of Consciousness Psychotherapy and Yoga Practices by RN Jha, Vidyanidhi Prakashan, Delhi, 2016
7. Himachal Pradesh History, Culture & Economy by Mian Goverdhan Singh & Prof. Dr. C.L. Gupta.

SUGGESTED DISTRIBUTION OF MARKS (Internal Assessment)		
Project Component	**Time Allotted(Hrs)**	**Marks Allotted(%)**
Unit 1 : Indian Knowledge System (IKS)	8	25%
Unit 2 : Modern Science	6	20%
Unit 3 : Traditional knowledge	5	15%
Unit 4 : Yoga and Holistic Health Care	8	25%
Unit 5 : Himachal Pradesh: A Basic Information	5	15%
Total	32	100%

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