BASIC ELECTRICAL AND ELECTRONICS **Course Code : 313307**

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Chemical Engineering/ Mechanical Engineering/ Production Engineering/ Polymer Technology**
Programme Code	**: AE/ AL/ CH/ ME/ PG/ PO**
Semester	**: Second**
Course Title	**: BASIC ELECTRICAL AND ELECTRONICS**
Course Code	**: 313307**

I. RATIONALE

Modern engineering systems, irrespective of the field, are increasingly incorporating smart technologies that rely on electrical and electronics components. Many engineering projects involve the integration of mechanical, electrical and electronic components. A well-rounded education in electrical and electronics principles enables engineers to work seamlessly across disciplines. In Chemical Engineering, Agricultural Engineering and Polymer Technology, precise measurement and control of variables are crucial. The fourth industrial revolution emphasizes the integration of digital technologies into manufacturing and engineering processes. Electrical and electronics knowledge is fundamental for implementing Industry 4.0 concepts in Engineering fields .This course will develop skills in handling tools and equipment related electrical and electronics engineering and provide the necessary foundation for understanding, maintaining and implementing advanced systems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcomes through various teaching learning experiences: Use Electrical and Electronics equipment safely in mechanical engineering applications

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use Principles of electrical and magnetic circuits to solve mechanical engineering broadly defined problems.
- CO2 - Use of Transformer and Electric motors for given applications.
- CO3 - Suggest suitable electronic component for given mechanical engineering application.
- CO4 - Use of diodes and transistors as a relevant component in given electric circuits of . mechanical engineering application

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313307	BASIC ELECTRICAL AND ELECTRONICS	BEE	AEC	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100

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Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the given technical terms related to Electric and Magnetic circuits . TLO 1.2 Identify analogy between Electric and Magnetic Circuits. TLO 1.3 Apply Fleming's right hand rule and Lenz's law for determination of direction of induced emf in the given situation. TLO 1.4 Explain attributes of the given AC quantities. TLO 1.5 Find currents and voltages in the given series and parallel AC circuits.	**Unit - I Electric and Magnetic Circuit** 1.1 1 Electric circuits E.M.F, Potential difference, power, Magnetic circuits M.M.F, magnetic force, permeability. 1.2 Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, dynamically induced emf. 1.3 Statically induced emf. (a) Self induced emf (b) Mutually induced emf; Equations of self and mutual inductance. 1.4 A .C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor. 1.5 Voltage and Current relationship in Star and Delta connections. Working of Batteries, wiring specifications and IS electrical standards for safety and appliances.	Chalk-Board Presentations Videos on Flemings Right hand rule and Lenz Law

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain with sketches the construction and working principle of the given type of single phase transformer. TLO 2.2 Explain with sketches the working principle of the given autotransformer. TLO 2.3 Describe with sketches the construction of the given single phase motor. TLO 2.4 Explain with the sketches the working principle of the given single phase induction motors.	**Unit - II Transformer and single phase induction motor** 2.1 General construction and principle of different type of transformers, EMF equation and transformation ratio of transformers. 2.2 Auto transformers. Working Principle and applications 2.3 Construction and Working principle of single phase AC. motor. Types of single phase motors, applications of single phase motors. 2.4 Applications of Induction motors	Chalk-Board Demonstration Hands-on
3	TLO 3.1 Differentiate between the given active and passive components. TLO 3.2 Determine the value of given resistor and capacitor using color code and printed information on components . TLO 3.3 Explain the given signal parameters with sketches. TLO 3.4 Identify the given type of ICs based on the IC number	**Unit - III Electronic Components and Signals** 3.1 Electronic Components : Passive and Active components: Resistor, Capacitor, Inductor, symbols color codes, specifications. 3.2 Voltage and current sources, signals: Waveform (Sinusoidal, triangular and square). 3.3 Time and frequency domain representation of signals.Amplitude, frequency, phase, wavelength. 3.4 Integrated circuits - Analog and Digital.	Chalk-Board Demonstration of components Hands-on
4	TLO 4.1 Explain with the sketches the working of given type of diode using its V-I characteristics. TLO 4.2 .Explain with the sketches the working of given type of rectifier using circuit diagram. TLO 4.3 Justify the given selection of power supply and LEDs for the given circuit. TLO 4.4 Explain with the sketches the application of the given type of transistor as a switch. TLO 4.5 Compare the performances of the given transistor configurations.	**Unit - IV Diodes and Bipolar Junction Transistor** 4.1 Diodes and its Applications: P-N junction diode: symbol, construction working and applications ,Zener diode: working, symbol, voltage regulator. 4.2 Rectifiers: Half wave, Full wave, Bridge rectifier Performance parameters: PIV, ripple factor, efficiency. 4.3 Light Emitting Diodes: symbol, construction, working principle and applications. 4.4 BJT Symbol, construction, working principle Transistor as switch and amplifier. 4.5 Input and Output characteristics: CE configurations, Operating regions: Cut-off, saturation Active Region.	Chalk-Board Demonstration Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Measure voltage and current in single phase circuits with resistive load using appriopriate meters	1	* Voltage and Current measurement	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Measure power required by single phase circuit with resistive load.	2	* Power measurement of single phase circuit	2	CO1
LLO 3.1 Measure Energy consumed by given equipment using energy meter.	3	Energy measurement	2	CO1
LLO 4.1 Measure average value, peak value and RMS value of AC waveform using CRO./ DSO LLO 4.2 Measure time and frequency of AC waveform using CRO./ DSO	4	AC signal parameters	2	CO1
LLO 5.1 Make a star and delta connection to measure line and phase voltage	5	* Line and Phase voltage measurement of star - delta connection circuit	2	CO1
LLO 6.1 Test given battery using digital multimeter.	6	* Battery Testing	2	CO1
LLO 7.1 Connect Single phase transformer for measuring input and output quantities LLO 7.2 Determine its turns ratio	7	* Input and output quantities of Single phase transformer	2	CO2
LLO 8.1 Test primary and secondary winding to measure continuity of transformer.	8	Continuity test of transformer-primary and secondary windings	2	CO2
LLO 9.1 Measure output voltage of auto transformer	9	Auto transformer	2	CO2
LLO 10.1 Identify parts of single phase induction motor.	10	* Single phase induction motor	2	CO2
LLO 11.1 Select the suitable gauge of wire for given electrical application.	11	* Electrical wire specifications	2	CO2
LLO 12.1 Build the switch board for given requirement by connecting suitable coloured wire to respective terminals .	12	* Electrical Swichboard assembly	2	CO2
LLO 13.1 Identify Passive electronic components on given electronics circuit	13	* Passive electronic components	2	CO3
LLO 14.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 14.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	14	* Resistors in series and parallel connections	2	CO3
LLO 15.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 15.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	15	Capacitors in series and Parallel connections	2	CO3
LLO 16.1 Use LCR-Q meter for measuring the value of given Inductor and Capacitors.	16	* LCR-Q meter	2	CO3
LLO 17.1 Identify various active electronic components in given circuit.	17	* Active electronic components	2	CO3
LLO 18.1 Test the given P N junction diode using multi meter	18	* P N Junction diode	2	CO4
LLO 19.1 Multi colour LEDs.	19	Multi colour LEDs	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 20.1 Identify type of seven segment display (Common anode / Common cathode)) LLO 20.2 Testing of seven- segment display.	20	* Seven- segment display	2	CO4
LLO 21.1 Built/ Test Half Wave Rectifier.	21	Half Wave Rectifier	2	CO4
LLO 22.1 Test Full Wave Rectifier using virtual Lab.	22	Full Wave Rectifier	2	CO4
LLO 23.1 Build/Test Bridge Rectifier constructed using four diodes LLO 23.2 Test bridge rectifier package	23	Bridge Rectifier	2	CO4
LLO 24.1 Identify three terminals of transistors using multimeter.	24	Three terminals of transistors	2	CO4
LLO 25.1 Test the performance of NPN transistor.	25	Testing of NPN transistor	2	CO4
LLO 26.1 Soldering and de- soldering given passive active components on PCB	26	* Soldering and De soldering	2	CO4
LLO 27.1 Test the performance of zener diode	27	Zener diode	2	CO4
LLO 28.1 Identify components of flasher circuits	28	Electronic flasher circuit	2	CO4
LLO 29.1 Identify terminals of three terminal positive and negative voltage regulator	29	* Three terminal voltage regulators	2	CO4
LLO 30.1 Build and test + 5 V regulated D C power supply using three terminal voltage regulator .	30	Regulated Power Supply	2	CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase Autotransformer: Single phase, Input 0-230,10 A, Output:0-270 Volts	1,2
2	Measurement Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 Mohm), diode and transistor testing mode	4,6,12,14,17,18,19,20,21,25,13,9
3	Lamp Bank - 230 V 0-20 A	5
4	Single phase auto transformer-Single Phase Input 0-230,10A,output: 0-270Volts	7,8
5	Single Phase Induction Motor - 230 V 50 Hz AC supply	11

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
6	LCR Q Meter: Parameter L-Q, C-D, R-Q and Z-Q Frequency 00 Hz, 120 Hz and 1 KHz Accuracy Basic Accuracy : 0.3% Display 5 digits display for both primary and secondary parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 H Measurement C 100 Hz, 120Hz 1 pF – 9999 mF Range 1 KHz 0.1 pF - 999.9 mF R, |Z| 0.0001V- 999.9 MV D, Q 0.0001 – 9999 D% 0.0001% - 9999% Test Level 120 Hz 0.3 Vrms (1 ±15%) (Range Auto 1 KHz and Open 100 Hz 0.42 Vrms (1±15%) Circuit) Ranging Mod Auto and Hold Equ	15
7	Function Generator: Frequency range 0.1Hz to 30 MHz sine, square, triangular, ramp and pulse generator, Output amplitude 20V open circuited, Output impedance 50 ohms. Facility to indicate output frequency and amplitude on display	22,23,24,29
8	CRO: Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Readout , USB interface or CRO with higher specifications	26,27,28,30
9	Single Phase Direct Measuring Energy Meter :100A 176 to 276V AC	3
10	Simulation software: Multisim, Proteus	23
11	Clamp on Meter: 750 V, 2000 Counts	1,2
12	Digital Storage Oscilloscope: 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	27,28,30

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Electric and Magnetic Circuit	CO1	7	0	0	0	0
2	II	Transformer and single phase induction motor	CO2	8	0	0	0	0
3	III	Electronic Components and Signals	CO3	7	0	0	0	0
4	IV	Diodes and Bipolar Junction Transistor	CO4	8	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For FA PR ,Formative (Continuous) assessment shall be based on process and product related performance indicators. Course teacher may assign 60%, weightage for process and 40% weightage for product related LL work .

Summative Assessment (Assessment of Learning)

- For SA PR At the end of semester PR examination will be conducted by course teacher and based on PR exam performance marks out of 50 will be allocated

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XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	1	-	1	-	-	1			
CO2	2	-	-	2	-	-	1			
CO3	1	-	-	1	-	-	1			
CO4	1	1	1	1	-	-	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mittle and Mittal	Basic Electrical Engineering	McGraw Education, New Delhi, edition 2017, ISBN-13 978-0070593572
2	Jegathesan, V	Basic Electrical and Electronics Engineering	Wiley India, New Delhi, edition-2015 ISBN 978-8126529513
3	Sedha, R.S.	A Text book of Applied Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978-8121927833
4	Mehta, V.K. Mehta, Rohit	Principles of Electronics	S. Chand and Company, New Delhi, edition-2014, ISBN-13-9788121924504
5	Bell Devid	Fundamental of Electronic Devices and Circuits	Oxford University Press, New Delhi edition-2015 ISBN 978-0195425239
6	Susan S Mathew Saji T Chacko	Fundamental of Electrical and Electronics Engineering	Khanna Book Publishing Co (P) Ltd. New Delhi 978-93-91505-59-2

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://fossee.in/ (Open Source Electronics Simulation software) https://cloud.scilab.in/ (Open Source Scilab Cloud for Electronics Simulation)	Smulation
2	https://www.electrical4u.com/fleming-left-hand-rule-and-fleming-right-hand-rule/	Flemings Right hand and left hand rule
3	https://www.electrical4u.com/lenz-law-of-electromagnetic-induction/	Lenz's Law
4	https://www.animations.physics.unsw.edu.au/jw/	Electronic components, A.C. circuits, transformer, Electric motors.
5	https://en.wikipedia.org/wiki/Transformer	Transformer
6	http://www.alpharubicon.com/altenergy/understandingAC.htm	A.C. Current

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Sr.No	Link / Portal	Description
7	https://www.learningaboutelectronics.com/Articles/	Electronic components
8	https://learn.sparkfun.com/tutorials/transistors	transistors
9	https://www.technologystudent.com/elec1/transis1.htm	transistors
10	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category_id/5	IS standards for electrical safety and appliances

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