INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**				
Course Code	AEEB04				
Programme	B.Tech				
Semester	II	ME			
	III	AE			
Course Type	Foundation				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	1.5
Chief Coordinator	Ms. B Manogna, Assistant Professor				
Course Faculty	Ms. B Manogna, Assistant Professor Ms. B Navothna, Assistant Professor				

I. COURSE OVERVIEW:

Electrical and Electronics Engineering course deals with the concepts of electrical circuits, basic law's of electricity, different methods to solve the electrical networks and the instruments to measure the electrical quantities. It also focuses on the construction, operational features of energy conversion devices such as DC and AC machines, Transformers. It also emphasis on basic electronics semiconductor devices and their characteristics and operational features.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHSB04	I	Waves and Optics	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Basic Electrical and Electronics Engineering	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for Continuous Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory			Total Marks
Type of Assessment	CIE Exam	Quiz	AAT	
CIA Marks	20	05	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 20 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Seminar
PO 2	**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	2	Five Minutes Video
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Assignment

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	1	Seminar
PSO 2	**Modelling and Simulation Practices:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	-	-
PSO 3	**Successful Career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become Technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand Kirchhoff laws and their application in series and parallel circuits.
II	Discuss principle and operation of measuring instruments.
III	Analyze the characteristics of alternating quantities, electrical machines.
IV	Illustrate the V-I characteristics of various diodes and bi-polar junction transistor.

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the basic concepts of electricity, applications of Kirchhoff laws and source transformation technique to complex circuits. Basic principles of indicating instruments.	CLO 1	Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law.
		CLO 2	Use of series-parallel concepts for simplifying circuits.
		CLO 3	Use star delta transformation for simplifying complex circuits.
		CLO 4	Generalize operation and principle of measuring instruments.
CO 2	Explore to the working principle of dc machine, various types and determine the torque equation of dc motor, EMF equation of dc generator purpose of three-point starter.	CLO 5	Demonstrate the working principle of DC motor, DC generator.
		CLO 6	Describe the construction of DC motor and DC generator.
		CLO 7	Classify the types of DC motor and generator with characteristics and voltage, current and power equations.
		CLO 8	Derive the EMF equation of DC generator, and various problems on EMF equation.
		CLO 9	Torque equation of DC motor and understand the purpose of three point starter.

COs	Course Outcome	CLOs	Course Learning Outcome
CO 3	Summarize various alternating quantities and explain working principle of induction motor, alternators and transformers.	CLO 10	List out various alternating quantities such as Sinusoidal AC voltage, average and RMS values, form and peak factor, and understand concept of three phase alternating quantity.
		CLO 11	Discuss the principle of operation of induction motor.
		CLO 12	Explain the construction and characteristics of alternator.
		CLO 13	Explain the construction and characteristics of 3-phase induction motor.
		CLO 14	Explain the principle and construction of Transformer.
CO 4	Discuss the basic theory of semi-conductor diode, rectifier, zener diode and their characteristics.	CLO 15	Understand the working of semi-conductor diode and its V-I characteristics.
		CLO 16	Discuss the operation of half wave, full wave and bridge rectifiers.
		CLO 17	Summarize various alternating quantities of half wave, full wave and bridge rectifiers.
		CLO 18	Apply the concept of diodes in converting AC to DC rectification process.
		CLO 19	Compare the operation of half wave, full wave and bridge rectifiers.
CO 5	Explain the concept of transistor in various configurations and give its applications.	CLO 20	Distinguish the different configurations of transistor.
		CLO 21	Differentiate the operation of Diodes and transistors.
		CLO 22	Understand the concept of biasing and load line of transistor.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB04.01	CLO 1	Analyze the circuits using Kirchhoff's current and Kirchhoff's voltage law.	PO1	3
AEEB04.02	CLO 2	Use of series-parallel concepts for simplifying circuits.	PO1	3
AEEB04.03	CLO 3	Use star delta transformation for simplifying complex circuits.	PO1	3
AEEB04.04	CLO 4	Generalize operation and principle of measuring instruments.	PO2	2
AEEB04.05	CLO 5	Demonstrate the working principle of DC motor, DC generator.	PO2	2
AEEB04.06	CLO 6	Describe the construction of DC motor and DC generator.	PO2	2
AEEB04.07	CLO 7	Classify the types of DC motor and generator with characteristics and voltage, current and power equations.	PO2	2
AEEB04.08	CLO 8	Derive the EMF equation of DC generator, and various problems on EMF equation.	PO2	2
AEEB04.09	CLO 9	Torque equation of DC motor and understand the purpose of three point starter.	PO2	2
AEEB04.10	CLO 10	List out various alternating quantities such as Sinusoidal AC voltage, average and RMS values, form and peak factor, and understand concept of three phase alternating quantity.	PO1	3

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AEEB04.11	CLO 11	Discuss the principle of operation of induction motor.	PO2	2
AEEB04.12	CLO 12	Explain the construction and characteristics of alternator.	PO4	2
AEEB04.13	CLO 13	Explain the construction and characteristics of 3-phase induction motor.	PO2	2
AEEB04.14	CLO 14	Explain the principle and construction of Transformer.	PO2	2
AEEB04.15	CLO 15	Understand the working of semi-conductor diode and its V-I characteristics.	PO1	3
AEEB04.16	CLO 16	Discuss the operation of half wave, full wave and bridge rectifiers.	PO4	2
AEEB04.17	CLO 17	Summarize various alternating quantities of half wave, full wave and bridge rectifiers.	PO4	2
AEEB04.18	CLO 18	Apply the concept of diodes in converting AC to DC rectification process.	PO1	3
AEEB04.19	CLO 19	Compare the operation of half wave, full wave and bridge rectifiers.	PO4	2
AEEB04.20	CLO 20	Distinguish the different configurations of transistors.	PO4	2
AEEB04.21	CLO 21	Differentiate the operation of Diodes and transistors.	PO4	2
AEEB04.22	CLO 22	Understand the concept of biasing and load line of transistor.	PO4	2

3= High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)			Program Specific Outcomes (PSOs)
	PO 1	PO 2	PO 4	PSO1
CO 1	3	2		1
CO 2	3	2		
CO 3	3	2	2	1
CO 4	3	2		1
CO 5			2	

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												1		

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 2	3														
CLO 3	3												1		
CLO 4		2													
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9		2											1		
CLO 10	3												1		
CLO 11		2													
CLO 12				2											
CLO 13		2													
CLO 14		2													
CLO 15	3														
CLO 16				2									1		
CLO 17				2									1		
CLO 18	3														
CLO 19				2											
CLO 20				2									1		
CLO 21				2									1		
CLO 22				2											

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4,PSO1	SEE Exams	PO1, PO2, PO4,PSO1	Assignments	PO4	Seminars	PO1,PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4,PSO1						

XIV. ASSESSMENT METHODOLOGIES – INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XV. SYLLABUS

Module-I	**ELECTRICCIRCUITS,ELECTROMAGNETISM AND INSTRUMENTS**
Electrical Circuits: Basic definitions, types of elements, Ohm's Law, resistive networks, inductive networks, capacitive networks, Kirchhoff's Laws, series, parallel circuits and star delta transformations, simple problems, Faradays law of electromagnetic induction; Instruments: Basic principles of indicating instruments, permanent magnet moving coil and moving iron instruments	
Module-II	**DC MACHINES**
DC Machines: Principle of operation of DC generator, EMF equation, principle of operation of DC motors, torque equation, types of DC machines, applications, three point starter.	
Module-III	**ALTERNATING QUANTITIES AND AC MACHINES**
Alternating Quantities: Sinusoidal AC voltage, average and RMS values, form and peak factor, concept of three phase alternating quantity; Transformer: Principle of operation, EMF equation, losses, efficiency and regulation. Three Phase Induction Motor: Principle of operation, slip, slip torque characteristics, efficiency, applications; Alternator: Principle of operation, EMF Equation, efficiency, regulation by synchronous impedance method.	
Module-IV	**SEMICONDUCTOR DIODE AND APPLICATIONS**
Semiconductor diode: P-N Junction diode, symbol, V-I characteristics, half wave rectifier, full wave rectifier, bridge rectifier and filters, diode as a switch, Zener diode as a voltage regulator.	
Module-V	**BIPOLAR JUNCTION TRANSISTOR AND APPLICATIONS**
Bipolar junction transistor: Working principle of transistors, DC characteristics, CE, CB, CC configurations, biasing, load line, applications.	
Text Books:	
1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2004. 2. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013. 3. Willianm Hayt, Jack E Kemmerly S M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition,2010. 4. J P J Millman, C C Halkias, Satyabrata Jit, "Millman"s Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 1998. 5. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006. 6. R L Boylestad, Louis Nashelsky, "Electronic Devices and Circuits", PEI / PHI, 9th Edition, 2006.	
Reference Books:	
1. David A Bell, "Electric Circuits", Oxford University Press, 9th Edition, 2016. 2. U A Bakshi,Atul P Godse "Basic Electrical and Electronics Engineering", Technical Publications, 9th Edition, 2016. 3. A Bruce Carlson, "Circuits", Cengage Learning, 1st Edition, 2008. 4. M Arshad, "Network Analysis and Circuits", Infinity Science Press, 9th Edition, 2016.	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Discuss the basic definitions of voltage, current, power and energy	CLO 1	T2: 1.2-1.8 R2:1.1
2	Understand the concept of Ohm's Law	CLO 1	T2: 1.9 R2:1.5
3	Discuss different elements in power systems and sources	CLO 1	T2:1.10 R2:1.2&1.4
4-5	Describe voltage-current relationship of resistive networks, inductive networks, capacitive networks	CLO 1	T2: 2.3-2.5 R2:1.6
6	Explain Kirchhoff's laws for electrical networks	CLO 1	T2: 1.12 R2:1.14
7-8	Understand series, parallel circuits	CLO 1	T2: 2.6 R2:1.7&1.8
9	Derive the formula for Star delta and delta star transformations techniques.	CLO 2	T2: 2.7 R2:1.12
10	Analyze networks using reduction techniques.	CLO 2	T2: 2.6 R2:1.7&1.8
11	Understand the concept of faradays laws	CLO 3	T2: 1.11 R2:6.2
12	Understand working of different measuring instruments	CLO 3	T2: 10.4 R2:4.0
13-14	Understand working of different measuring instruments	CLO 3	T2: 10.5.1.1 R2:4.0
15-16	Understand working of different measuring instruments	CLO 3	T2: 10.5.1.3 R2:4.0
17	Discuss what is a DC machine	CLO 4	T2: 7.1 R2:5.2
18	Understand the working principle of DC machine	CLO 4	T2: 7.6 R2:5.3
19-20	Demonstrate the cross section view of a DC machine	CLO 5	T2: 7.2 R2:5.4
21-22	Derive the mathematical equation of EMF induced in a DC generator	CLO 7	T2: 7.6.1 R2:5.7
23	Classify the types of DC generator	CLO 6	T2: 7.6.3 R2:5.10,5.11,
24	Derive mathematical equation of torque generated in a DC motor	CLO 4	T2: 7.7 R2:5.16
25	Understand the applications of DC motor	CLO 6	T2: 7.7.6 R2:5.21,5.22
26	Understand the three point starter	CLO 7	T2:7.7.5 R2:5.20
27	Understand the concepts of alternating quantities	CLO 4	T2: 4.1 R2:2.1
28	Understand the representation of sinusoidal quantity and analyzing	CLO 4	T:4.5-4.6 R2:2.2
29	Understand three phase systems	CLO 4	T2: 5.2.4.1 R2:3.2
30	Understand the working principle of Transformer	CLO 4	T2: 6.5 R2:602
31	Derive mathematical equation of EMF induced in a single phase transformer	CLO 7	T2: 6.6.1 R2:6.6
32	Understand the percentage efficiency and voltage regulation	CLO 7	T2: 6.9-6.10 R2:6.13&6.15

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
33	Understand the working principle of induction motor	CLO 8	T2: 9.3 R2:7.2
34-35	Analyze the speed torque characteristics	CLO 9	T2: 9.3.1 R2:7.8
36	Understand the working principle of Alternator	CLO 9	T2: 8.4 R2:7.11
37	Derive the mathematical equation of EMF induced in a Alternator	CLO 9	T2: 8.4 R2:7.13
38	Analyze the percentage efficiency of an alternator.	CLO 9	T2: 8.8 R2:7.16
39-40	Analyze the percentage voltage regulation of alternator.	CLO 9	T2: 8.8 R2:7.21
44-47	Understand the functioning of P-N Junction diode	CLO 12	T4: 4.11 R2:8.1
48-50	Understand and analyze P -N diode as half wave rectifier, full wave rectifier, bridge rectifier and filters	CLO 11	T4: 4.23 R2:8.8,8.17
51-53	Understand the functioning of Zener diode as a voltage regulator.	CLO 12	T4: 4.19,5.2 R2:8.22.5
54	Analyze simple problems on diodes.	CLO 12	T4: 4.23 R2:8.23
55-56	Understand the concept of bipolar junction: DC characteristics,	CLO 14	T4: 6.4-6.5 R2:9.1
57-59	Examine CE, CB, CC configurations.	CLO 14	T4: 6.6 R2:9.21,9.22,
60	Analyze biasing and load line,	CLO 14	T4: 6.3 R2:9.3
61-63	Model Transistor as an amplifier	CLO 14	T4: 6.7 R2:9.5
64-65	Analyze simple problems on transistors.	CLO 14	T4: 6.6 R2:9.7

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S. no	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	To improve standards and analyze the concepts.	Guest lectures	PO2	PSO1
2	Voltage - Current relationship of passive elements for different input signals - ramp, saw tooth and triangular.	Seminar/ NPTEL	PO1	PSO1
3	Resistance colour coding	NPTEL	PO1	PSO1

Prepared by:
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