



Indra Ganesan

COLLEGE OF ENGINEERING

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'B+' Grade, 2(f) & 12B Status Institution by UGC

IG Valley, Madurai Main Road, Manikandam, Tiruchirappalli - 620012

NAAC DOCUMENTS

QUALITY INDICATOR FRAME WORK

CRITERION – 1

CURRICULAR ASPECTS

SUBMITTED BY

IQAC

INTERNAL QUALITY ASSURANCE CELL

INDRA GANESAN COLLEGE OF ENGINEERING





Indra Ganesan

COLLEGE OF ENGINEERING

Madurai Main Road (NH-45B), Manikandam, Tiruchirappalli - 620 012
Approved by AICTE, NewDelhi & Affiliated to Anna University, Chennai
NAAC Accredited, 2(F) Status Institution by UGC



Criteria 1	Curricular Aspects	100
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1.1 Curricular Planning and Implementation (20)

1.1.1 The Institution ensures effective curriculum planning and delivery through a well-planned and documented process including Academic calendar and conduct of continuous internal Assessment

Table of Content

S. No	Description
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INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PREFACE OF THE COURSE FILE

Batch : 2019-2023

Academic Year : 2020-2021 / EVEN

Program : ELECTRICAL AND ELECTRONICS ENGINEERING

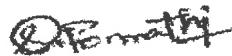
Year & Semester : 2nd Year / 4th Semester

Course Code : EE8403 NBA Course Code: C212

Name of the Course : MEASUREMENT AND INSTRUMENTATION

Faculty in-charge : Mr.S.PONMATHI RAJITH KUMAR, AP / EEE

Signature of the Faculty in-charge



HoD / EEE

Dr. G. Balakrishnan, M.E., Ph.D.
Principal
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IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABUS

EE8403	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Basic functional elements of instrumentation
- Fundamentals of electrical and electronic instruments
- Comparison between various measurement techniques
- Various storage and display devices
- Various transducers and the data acquisition systems

UNIT I INTRODUCTION

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration- Principle and types of analog and digital voltmeters, ammeters.

9

UNIT II ELECTRICAL AND ELECTRONIC INSTRUMENTS

Principle and types of multi meters – Single and three phase watt meters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

9

UNIT III COMPARATIVE METHODS OF MEASUREMENTS

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

9

UNIT IV STORAGE AND DISPLAY DEVICES

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.


9

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

9

TOTAL : 45 PERIODS


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OUTCOMES:

- To acquire knowledge on Basic functional elements of instrumentation
- To understand the concepts of Fundamentals of electrical and electronic instruments
- Ability to compare between various measurement techniques
- To acquire knowledge on Various storage and display devices
- To understand the concepts Various transducers and the data acquisition systems
- Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System.

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2010.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013.
3. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, III Edition 2010.
2. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.
3. David Bell, 'Electronic Instrumentation & Measurements', Oxford University Press, 2013.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

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Signature of the HoD/EEE

(Signature)

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Lecture Schedule

Degree/Program: B.E / EEE

Course code &Name: EE8403 Measurement and Instrumentation

Duration: 2020 - 2021

Semester: IV

Faculty: Mr.S.PONMATHI RAJITH KUMAR, AP / EEE

AIM:

To impart knowledge about the configuration of the electrical power systems.

OBJECTIVES:

- To educate the fundamental concepts and characteristics of measurement and errors.
- To impart the knowledge on the functional aspects of measuring instruments.
- To infer the importance of various bridge circuits used with measuring instruments..
- To educate the fundamental working of sensors and transducers and their applications.
- To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles

PREREQUISITES: Circuit theory, Electromagnetic theory.

COURSE OUTCOMES:

After the course, the student should be able to:

CO	Course Outcomes	POs	PSOs
C212.1	To acquire knowledge on Basic functional elements of instrumentation	1,2,3,4	1,2
C212.2	To understand the concepts of Fundamentals of electrical and electronic instruments	1,2,3,4	1,2
C212.3	Ability to compare between various measurement techniques	1,2,3,4	1,2
C212.4	To acquire knowledge on Various storage and display devices	1,2,3,4	1,2
C212.5	To understand the concepts Various transducers and the data acquisition systems	1,2,3,4	1,2
C212.6	Ability to model and analyze electrical and electronic Instruments and understand the operational features of display Devices and Data Acquisition System	1,2,3,4	1,2



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S. No	Date	Period	Topics to be Covered	Book & Page. No.
UNIT - I -			CONCEPTS OF MEASUREMENTS	Target periods :9
1	18.02.21	1	Instruments: classification, applications	T1,R1
2	19.02.21	2	Elements of a generalized measurement system	T1,R1
3	20.02.21	6	Static characteristics	T1,R1
4	22.02.21	6	dynamic characteristics	
5	25.02.21	1	Errors in measurement	T1,R1
6	26.02.21	2	Statistical evaluation of measurement data.	T1,R1
7	27.02.21	1	REVISION	T1,R1
8	01.03.21	6	PROBLEMS AND REVISION	T1,R1
9	02.03.21	8	REVISION	T1,R1
UNIT II MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS				Target periods :9
10	06.03.21	2	Classification of instruments	T1,R1
11	08.03.21	6	moving coil	T1,R1
12	10.03.21	8	moving iron meters	T1,R1
13	11.03.21	1	Induction type,	T1,R1
14	12.03.21	2	dynamometer type watt meters	T1,R1
15	12.03.21	6	Energy meter	T1,R1
16	13.03.21	6	Megger	T1,R1
17	15.03.21	6	Instrument transformers (CT)	T1,R1
18	16.03.21	8	Instrument transformers (PT).	T1,R1
19				
19	20.03.21	1	Wheatstone bridge	T1,R1
20	22.03.21	6	Kelvin double bridge	
21	23.03.21	8	Maxwell bridges	T1,R1
22	25.03.21	1	Hay bridges	T1,R1
23	26.03.21	2	Wien bridges	T1,R1
24	26.03.21	7	Schering bridges	T1,R1
25	27.03.21	2	Errors and compensation in A.C. bridges	T1,R1
26	29.03.21	6	Instrumentation Amplifiers.	T1,R1
27	31.03.21	8	PROBLEMS AND REVISION	T1,R1
UNIT IV - TRANSDUCERS FOR MEASUREMENT OF NON ELECTRICAL PARAMETER				Target Periods :9
28	09.04.21	2	Classification of transducers	T1,R1
29	10.04.21	6	Measurement of pressure	
30	12.04.21	6	Measurement of temperature,	T1,R1
31	13.04.21	8	Measurement of displacement	T1,R1
32	15.04.21	1	Measurement of flow,	T1,R1
33	16.04.21	2	-Measurement of angular velocity	
34	17.04.21	1	Digital transducers	T1,R1
35	19.04.21	6	Smart Sensors.	T1,R1
36	20.04.21	8	REVISION	T1,R1
UNIT V - DIGITAL INSTRUMENTATION				Target Periods:9
37	24.04.21	2	A/D converters: types and characteristics	T1,R1
38	25.04.21	6	Sampling, Errors	T1,R1
39	27.04.21	8	Measurement of voltage, Current,	T1,R1


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40	28.04.21	8	frequency and phase	T1,R1
41	29.04.21	1	D/A converters: types and characteristics	T1,R1
42	30.04.21	2	DSO	T1,R1
43	30.04.21	6	Data Loggers	T1,R1
44	30.04.21	7	Basics of PLC programming and Introduction to Virtual Instrumentation	T1,R1
45	01.05.21	6	Instrument standards	T1,R1
Content Beyond the Syllabus				
46	01.05.21	8	Proximity sensor in mobile phones	Material

Book Reference - Text Books

Sl.	Title of the Book	Author	Publisher	Year
1.	A Course in Electrical & Electronic Measurements & Instrumentation',	A.K. Sawhney, Puneet Sawhney	Dhanpat Rai and Co, New Delhi, Edition	2011
2.	Electronic Instrumentation'	H.S. Kalsi,	Tata McGraw-Hill	2010

Book Reference – References

Sl	Title of the Book	Author	Publisher	Year
1.	'Electronics Instruments and Instrumentation Technology	M.M.S. Anand	Prentice Hall India, New Delhi,	2009
2.	Elements of Electronic Instrumentation and Measurement',	J.J. Carr,	Pearson Education India, New Delhi	2011
3.	Programmable Logic Controllers	W.Bolton,	6th Edition, Elsevier	2015

Website Reference:

<http://nptel.iitm.ac.in/courses.php?branch=Electrical>
www.freebookspot.com

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G. Ma. Lathi

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Identification of Curricular Gap & Content Beyond Syllabus(CBS)

Name of the Faculty : Mr.S.PONMATHI RAJITH KUMAR, AP / EEE

Course Code & Name: EE8403 MEASUREMENTS AND INSTRUMENTATION

Degree & Program: B.E. /EEE Semester & Section: IV

Academic Year: 2020 -2021 /EVEN

I. Mapping of Course Outcomes with POs & PSOs.(before CBS)

Table.1 Mapping of COs, C, PSOs with POs - before CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	2	-	2	-	-	-	3	3	3	3
CO2	3	2	3	2	-	-	-	-	-	3	-	3	3	3	3
CO3	3	2	3	-	-	2	-	-	-	-	-	3	3	3	3
CO4	3	2	3	-	-	-	-	2	-	-	-	3	3	3	3
CO5	3	2	3	2	-	-	-	-	-	-	-	-	3	3	3
AVG	3	2	3	2	-	2	-	2	-	3	-	3	3	3	3

II. Identification of content beyond syllabus.

Table.2 Identification of content beyond syllabus

Details of Content Beyond Syllabus(CBS) added	POs strengthened/ vacant filled	CO/Unit
Proximity sensor in mobile phones	PO5(2) Vacant filled	C212.5 & C212.6/ IV & V

III. Mapping of Course Outcomes with POs & PSOs. (After CBS)

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C212.1	3	2	1	1	-	-	-	-	-	2	1	1	2	2
C212.2	3	2	1	1	-	-	-	-	-	2	1	1	2	2
C212.3	3	2	1	1	-	-	-	-	-	2	1	1	2	2
C212.4	3	2	1	1	-	-	-	-	-	2	1	1	2	2
C212.5	3	2	1	1	*2	-	-	-	-	2	1	1	2	2
C212.6	3	2	1	1	*2	-	-	-	-	2	1	1	2	2
C212	3	2	1	1	*2	-	-	-	-	2	1	1	2	2

Table.3 Mapping of COs, C, PSOs with POs- after CBS.



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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Identification of Curricular Gap & Content beyond Syllabus (CBS) MATERIAL

Name of the Faculty: Mr.S.PONMATHI RAJITH KUMAR, AP / EEE

Course Code & Name: EE8403 MEASUREMENTS AND INSTRUMENTATION

Degree & Program: B.E. /EEE Semester & Section: IV

Academic Year: 2020 -2021 /EVEN

TOPIC: Biomedical Instrumentation

Bioinstrumentation or biomedical instrumentation is engineering concerned with devices and mechanics used to measure, evaluate, and treat biological systems. It focuses on using multiple sensors to monitor the physiological characteristics of a human or an animal.

Application:

Biomedical instrumentation has been used in the medical world of surgery since the beginning of time and continues to evolve to improve patient care. The continuous integration of imaging and assistive robotics has allowed for surgeries to be more precise as well as less invasive.

Types:

Direct/Indirect Invasive/Non-invasive Contact/Remote Sense/Actuate Dynamic/Static
Direct/Indirect In biomedical instrumentation we may have the sensing system measuring a physiological parameter directly, such as the average blood flow

- Pressure,
- Flow,
- Impedance,
- Temperature
- Chemical concentrations.


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After completing the course in Biomedical Instrumentation one can get opportunities in sectors like pharmaceuticals firms, medical equipment manufacturing units, Hospitals, Modern health care sectors, research and medical institutes, and biomedical equipment manufacturing companies.



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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

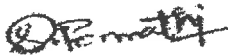
Assignment Question

Name of the Student: Hariharan E

AU Register Number: 811221105012

Assignment – 01		Date of Issue:	02.03.2021	Marks	10
Course code	EE8403	Course Title	MEASUREMENTS AND INSTRUMENTATION		
Year	II	Semester/Section	IV	Date of Submission:	10.03.2021

Q.No	Questions	CO
1	Explain the functional elements of measurement system with neat block diagram?	C212.1
2	With a neat block diagram explain the construction and operating principle of digital voltmeter.	C212.1



Name and Signature of the Faculty Incharge



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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Assignment Answer Sheet

Name of the Student: Hariharan E

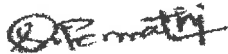
AU Register Number: 811221105012

Assignment – 01		Date of Issue:	02.03.2021	Marks	10
Course code	EE8403	Course Title	MEASUREMENTS AND INSTRUMENTATION		
Year	II	Semester/Section	IV	Date of Submission:	10.03.2021

Q.No	Questions	CO
1	Explain the functional elements of measurement system with neat block diagram?	C212.1
2	With a neat block diagram explain the construction and operating principle of digital voltmeter.	C212.1

Mark Allocation

Rubrics	Marks Allocated	Marks obtained
Content Quality	6	5
Presentation Quality	2	1
Timely submission	2	1
Total marks	10	7



Name and Signature of the Faculty Incharge





HoD/EEE


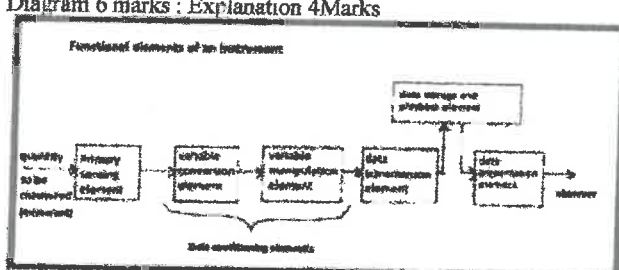
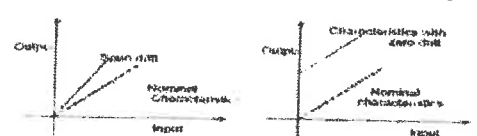

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Q.No.	Question	CO	BTS
PART A (Answer all the Questions 10 x 2 = 20 Marks)			
1	What is standard? What are the different types of standards? A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose.	CO3	K3
2	Define calibration. Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range.	CO3	K1
3	Give the international standards of instruments. These standards, often developed by international or national standards organizations, aim to ensure the reliability, safety, efficiency, and compatibility of instrumentation devices and systems used in various industries.	CO3	K2
4	What is drift? Genetic drift takes place when the occurrence of variant forms of a gene, called alleles, increases and decreases by chance over time.	CO3	K2
5	Define limiting errors. Limiting Error: The maximum allowable error in the measurement is specified in terms of true value, is known as limiting error. It will give a range of errors. It is always with respect to the true value, so it is a variable error.	CO3	K1
6	Define Range and Span. The algebraic difference between upper range value and lower range value is termed as "span" of the instrument	CO3	K1
7	What are the different types of standard available? Product standards. Product standards are national, European and international standards that establish agreements on the characteristics of products	CO3	K2
8	Draw the functional block diagram of an instrument. 	CO4	K3
9	Define Gross and Random errors. The gross error can only be avoided by taking the reading carefully. The systematic errors are mainly classified into three categories.	CO4	K2
10	What are the sources of error? All of these errors can be either random or systematic depending on how they affect the results	CO4	K3
PART B (Answer all the Questions 2 x 10 = 20 Marks)			
11a	Explain the functional elements of measurement system with neat block diagram? Diagram 6 marks : Explanation 4Marks 	CO1	K2
OR			
11b	Explain the static characteristics of measurement system in detail. Static system, the variables or properties of the system do not vary or change with time or any other independent variable. Static systems are characterized by equilibrium, stability, and the absence of motion or change. 	CO1	K2
12a	With a neat block diagram explain the construction and operating principle of digital voltmeter. It uses digital, analog or both techniques to generate a rectangular pulse. The width and frequency of the rectangular pulse is controlled by the digital circuitry inside the generator while amplitude and rise and fall time is controlled by analog circuitry. 	CO4	K3

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OR			
12b	<p>Discuss the different types of standards of measurement. Standards of Measurement are classified into the following categories:</p> <ul style="list-style-type: none"> • International Standards • Primary Standards • Secondary Standards • Working standards 5 Marks ; Explanation 5 marks 	CO4	K3
PART C (Answer all the Questions 1 x 10 = 10 Marks)			
13a	<p>Classify and explain the different errors of measurements.</p> <p>Errors may arise during the measurement process due to an assortment of factors. The classification of errors in measurement gives rise to four main types of errors. These include systematic, gross, random, and limiting. The causes and resolutions of these errors differ.</p> <p>(1) Systematic errors. With this type of error, the measured value is biased due to a specific cause. ... (2) Random errors. This type of error is caused by random circumstances during the measurement process. (3) Negligent errors.</p> <p style="text-align: center;">Explanation 10 marks</p>		K2
OR			
13b	<p>Describe the functional operation of energy meter</p> <div style="text-align: center;"> </div> <p style="text-align: center;">Explanation 10 marks</p>	CO3	K3

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IG VALLEY, MANIDANDAM, TIRUCHIRAPPALLI - 620 012
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING ACADEMIC
YEAR 2022 - 2023 (EVEN SEMESTER)
STUDENTS MARK STATEMENT- CO BASED

INTERNAL TEST-I

SUBJECT CODE & TITLE: EE3401 TRANSMISSION & DISTRIBUTION

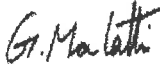
YEAR/SEM: II/IV

MONTH & YEAR:

S.NO	REG NO	STUDENT NAME	CO1 (26)	CO2 (2)	CO3 (12)	CO4 (10)	TOTAL (50)
1.	811219105001	ARULRAJ A	12	01	10	07	30
2.	811219105002	BARATH M.M	09	01	07	02	19
3.	811219105003	MANIKANDAN A	09	00	07	02	18
4.	811219105004	MANIKANDAN K	13	01	10	07	31
5	811219105005	PONNALAGU C	12	01	10	07	30
6	811219105006	SALAMON A	13	00	10	06	29
7	811219105007	SARAVANAKUMAR M	13	00	10	05	28
8	811219105008	SOLAIMATHI .K	10	00	10	07	27
9	811219105701	DHEVENTHIRAN .P	13	00	00	00	13
10	811219105301	VENKATRAMAN	13	01	10	07	31

Total No. of Candidates Present	10
Total No. of Candidates Absent	00
Total No. of Students Pass	07
Total No. of Students Fail	03
Percentage of Pass	70


STAFF INCHARGE


HoD/EEE


PRINCIPAL


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Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING
IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu - 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

ROOT CAUSE ANALYSIS


Faculty: S. Ponmathi Rajith Kumar
Program: BE & EEE
: I
: 90%

Course Code & Name : EE 8402 Measurement & Instrumentation
Semester & Section : II / A
University Exam/Month & Year: 2021-23
Achieved : 20 %

NO	REG	NAME OF THE STUDENT	CAUSES FOR FAILURE	SIGNATURE OF THE STUDENT WITH DATE	CORRECTIVE ACTION TAKEN	PREVENTIVE ACTION TAKEN
1.	811219105301	DHEVENTHIRAN.P	Presentation is not proper		Improve Presentation	Retest is Planned


Signature of the Faculty Member


Signature of the HoD/EEE


Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.



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IOAC Academic Audit Form

ACADEMIC YEAR: 2021-2022 SEMESTER VI

Name of Department: EEE Year / Sem / Sec: 01 / VI No. of Students Registered: 10

Details of Examination: IA TEST - I

S.No.	Course Code	List of Reg.No Verified	Course Log Book Verified (Y/N)	Course File Verified (Y/N)	No of students Attempted	No of Absentees	No of Failures	Pass %	Remarks
1	EE5601	811219105001 - 811219105301	Y	Y	10	-	1	90%	Refer
2	EE5602	811219105001 - 811219105301	Y	Y	10	-	-	100%	-
3	EE5601	811219105001 - 811219105301	Y	Y	10	-	-	100%	-
4	EE5602	811219105001 - 811219105301	Y	Y	10	-	1	90%	Refer
5	EE5601	811219105001 - 811219105301	Y	Y	10	-	-	100%	-

Verified by

External Member Name and Signature:

Dr. Santhosh K.

Internal Member Name and Signature:

Mr. D. Praveen

Overall Remarks:

- Retest should be conducted properly for students.
- Need to present in full details.

G. Manlathi

HoD/ EEE

IQAC Co-ordinator

IQAC Co-ordinator

Principal

Principal

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
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