SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

IV SEMESTER

EE3463 – MEASUREMENTS AND INSTRUMENTATION

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UNIT I - CONCEPTS OF MEASUREMENTS

IC Engines, BMEP and BSFC, Vehicle Fuel Economy, Emission Control Systems, Treatment of Diesel Exhaust Emissions. Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data.

PART A

Q.No	Questions	CO	BT Level	Competence
1.	Define an Internal Combustion (IC) engine.	1	BTL 1	Remembering
2.	What is meant by Brake Mean Effective Pressure (BMEP)?	1	BTL 1	Remembering
3.	Define Brake Specific Fuel Consumption (BSFC).	1	BTL 1	Remembering
4.	State the significance of BMEP in engine performance.	1	BTL 2	Understanding
5.	What is vehicle fuel economy?	1	BTL 1	Remembering
6.	List any two factors affecting vehicle fuel economy.	1	BTL 2	Understanding
7.	What are exhaust emissions in IC engines?	1	BTL 1	Remembering
8.	Name the major pollutants emitted from diesel engines.	1	BTL 1	Remembering
9.	What is meant by emission control system?	1	BTL 1	Remembering
10.	State the purpose of catalytic converters.	1	BTL 2	Understanding
11.	What is diesel exhaust after-treatment?	1	BTL 1	Remembering
12.	Define Diesel Particulate Filter (DPF).	1	BTL 1	Remembering
13.	Classify measuring instruments based on function.	1	BTL 2	Understanding
14.	What is a measurement system?	1	BTL 1	Remembering
15.	List the elements of a generalized measurement system.	1	BTL 1	Remembering
16.	What is accuracy in measurement?	1	BTL 1	Remembering
17.	Define precision with respect to measurement systems.	1	BTL 1	Remembering
18.	What is sensitivity of an instrument?	1	BTL 2	Understanding
19.	Define static characteristics of instruments.	1	BTL 1	Remembering
20.	What are dynamic characteristics of a measuring system?	1	BTL 1	Remembering
21.	What is measurement error?	1	BTL 1	Remembering
22.	Classify errors in measurement.	1	BTL 2	Understanding
23.	What is meant by statistical evaluation of data?	1	BTL 1	Remembering
24.	Define mean value in statistical analysis.	1	BTL 1	Remembering

PART B

1.	Explain the working principle of an IC engine and discuss its performance parameters.	(16)	1	BTL 3	Applying
2.	Calculate and interpret BMEP for a given IC engine.	(16)	1	BTL 3	Applying
3.	Analyze the importance of BSFC in comparing engine performance.	(16)	1	BTL 4	Analyzing
4.	Apply suitable methods to improve vehicle fuel economy.	(16)	1	BTL 3	Applying
5.	Analyze the factors affecting vehicle fuel economy.	(16)	1	BTL 4	Analyzing
6.	Explain various emission control systems used in IC engines.	(16)	1	BTL 3	Applying
7.	Analyze the formation of diesel exhaust emissions.	(16)	1	BTL 4	Analyzing
8.	Discuss the treatment methods for diesel exhaust emissions.	(16)	1	BTL 3	Applying
9.	Apply instrument classification to automotive measurements.	(16)	1	BTL 3	Applying
10.	Explain elements of a generalized measurement system with diagram.	(16)	1	BTL 3	Applying
11.	Discuss the static characteristics of measuring instruments.	(16)	1	BTL 4	Analyzing
12.	Explain dynamic characteristics of measurement systems.	(16)	1	BTL 3	Applying
13.	Apply error analysis techniques in measurements.	(16)	1	BTL 3	Applying
14.	Evaluate the different types of measurement errors.	(16)	1	BTL 4	Analyzing
15.	Explain the need for statistical evaluation of data.	(16)	1	BTL 3	Applying
16.	Illustrate the data using mean and deviation.	(16)	1	BTL 4	Analyzing
17.	Discuss the role of measurement systems in engine testing.	(16)	1	BTL 4	Analyzing

UNIT II - MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS

Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type watt meters – Energy meter – Megger – Instrument transformers (CT & PT).

PART A

Q.No	Questions	CO	BT Level	Competence
1.	Define measuring instruments.	2	BTL 1	Remembering
2.	Classify electrical measuring instruments.	2	BTL 1	Remembering
3.	What is a moving coil instrument?	2	BTL 1	Remembering
4.	State the principle of a PMMC instrument.	2	BTL 2	Understanding

5.	What is meant by moving iron instrument?		2	BTL 1	Remembering
6.	List the types of moving iron instruments.		2	BTL 1	Remembering
7.	Compare moving coil and moving iron instruments (any one point).		2	BTL 2	Understanding
8.	What is an induction type instrument?		2	BTL 1	Remembering
9.	State the operating principle of induction instruments.		2	BTL 2	Understanding
10.	What is a dynamometer type wattmeter?		2	BTL 1	Remembering
11.	Mention the use of a wattmeter.		2	BTL 1	Remembering
12.	What is an energy meter?		2	BTL 1	Remembering
13.	Define kilowatt-hour (kWh).		2	BTL 1	Remembering
14.	State the working principle of an energy meter.		2	BTL 2	Understanding
15.	What is a Megger?		2	BTL 1	Remembering
16.	State the purpose of a Megger.		2	BTL 2	Understanding
17.	What is an instrument transformer?		2	BTL 1	Remembering
18.	Define current transformer (CT).		2	BTL 1	Remembering
19.	Define potential transformer (PT).		2	BTL 1	Remembering
20.	Why are CTs and PTs used in power systems?		2	BTL 2	Understanding
21.	What is the function of a CT?		2	BTL 2	Understanding
22.	What is the function of a PT?		2	BTL 2	Understanding
23.	Mention any two advantages of instrument transformers.		2	BTL 2	Understanding
24.	State any one application of electrical measuring instruments.		2	BTL 1	Remembering
PART B					
1.	Explain the classification of electrical measuring instruments with examples.	(16)	2	BTL 3	Applying
2.	Explain the construction and working principle of a PMMC instrument.	(16)	2	BTL 3	Applying
3.	Discuss the advantages and limitations of moving coil instruments.	(16)	2	BTL 4	Analyzing
4.	Explain the construction and working of moving iron instruments.	(16)	2	BTL 3	Applying
5.	Compare moving coil and moving iron instruments in detail.	(16)	2	BTL 4	Analyzing

6.	Explain the operating principle of induction type instruments.	(16)	2	BTL 3	Applying
7.	Evaluate the induction type instruments are used only for AC measurements.	(16)	2	BTL 4	Analyzing
8.	Explain the construction and working of a dynamometer type wattmeter.	(16)	2	BTL 3	Applying
9.	Summarize the errors in dynamometer type wattmeters.	(16)	2	BTL 4	Analyzing
10.	Explain the working principle of a single-phase energy meter with diagram.	(16)	2	BTL 3	Applying
11.	Analyze the factors affecting the accuracy of an energy meter.	(16)	2	BTL 4	Analyzing
12.	Explain the construction and working of a Megger.	(16)	2	BTL 3	Applying
13.	Analyze the importance of insulation resistance measurement using a Megger.	(16)	2	BTL 4	Analyzing
14.	Explain the construction and working of current transformers (CT).	(16)	2	BTL 3	Applying
15.	Explain the construction and working of potential transformers (PT).	(16)	2	BTL 3	Applying
16.	Illustrate the necessity of CT and PT in high-voltage measurements.	(16)	2	BTL 4	Analyzing
17.	Compare CT and PT based on construction, operation, and applications.	(16)	2	BTL 4	Analyzing

UNIT III - AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS

Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers.

PART A

Q.No	Questions	CO	BT Level	Competence
1.	Define a Wheatstone bridge.	3	BTL 1	Remembering
2.	State the principle of Wheatstone bridge.	3	BTL 2	Understanding
3.	What are the applications of Wheatstone bridge?	3	BTL 2	Understanding
4.	What is a Kelvin double bridge?	3	BTL 1	Remembering

5.	Why is Kelvin double bridge preferred for low resistance measurement?		3	BTL 2	Understanding
6.	Define Maxwell bridge.		3	BTL 1	Remembering
7.	What type of impedance is measured using Maxwell bridge?		3	BTL 1	Remembering
8.	Define Hay bridge.		3	BTL 1	Remembering
9.	State the application of Hay bridge.		3	BTL 2	Understanding
10.	What is Wien bridge?		3	BTL 1	Remembering
11.	Mention one application of Wien bridge.		3	BTL 2	Understanding
12.	Define Schering bridge.		3	BTL 1	Remembering
13.	What parameters are measured using Schering bridge?		3	BTL 2	Understanding
14.	What are AC bridges?		3	BTL 1	Remembering
15.	List any two advantages of AC bridges.		3	BTL 2	Understanding
16.	What are errors in AC bridges?		3	BTL 1	Remembering
17.	List any two sources of error in AC bridges.		3	BTL 2	Understanding
18.	What is meant by compensation in AC bridges?		3	BTL 1	Remembering
19.	Why is shielding required in AC bridge measurements?		3	BTL 2	Understanding
20.	Define an instrumentation amplifier.		3	BTL 1	Remembering
21.	State the main features of an instrumentation amplifier.		3	BTL 2	Understanding
22.	What is CMRR?		3	BTL 1	Remembering
23.	Why is high CMRR required in instrumentation amplifiers?		3	BTL 2	Understanding
24.	Mention any one application of instrumentation amplifiers.		3	BTL 1	Remembering
	PART B				
1.	Explain the construction and working of a Wheatstone bridge with a neat diagram.	(16)	3	BTL 3	Applying
2.	Apply Wheatstone bridge principles to determine an unknown resistance.	(16)	3	BTL 4	Analyzing
3.	Explain the construction and working of Kelvin double bridge.	(16)	3	BTL 3	Applying
4.	Discuss the advantages of Kelvin double bridge over Wheatstone bridge.	(16)	3	BTL 4	Analyzing

5.	Explain the working principle of Maxwell bridge with phasor diagram.	(16)	3	BTL 3	Applying
6.	Analyze the suitability of Maxwell bridge for inductance measurement.	(16)	3	BTL 3	Applying
7.	Explain the construction and operation of Hay bridge.	(16)	3	BTL 4	Analyzing
8.	Compare Maxwell bridge and Hay bridge for inductance measurement.	(16)	3	BTL 3	Applying
9.	Explain the working principle of Wien bridge with applications.	(16)	3	BTL 3	Applying
10.	Illustrate the frequency measurement capability of Wien bridge.	(16)	3	BTL 4	Analyzing
11.	Explain the construction and working of Schering bridge.	(16)	3	BTL 4	Analyzing
12.	Analyze the use of Schering bridge in dielectric loss measurement.	(16)	3	BTL 3	Applying
13.	Explain various sources of errors in AC bridges.	(16)	3	BTL 4	Analyzing
14.	Evaluate the different error compensation techniques used in AC bridges.	(16)	3	BTL 3	Applying
15.	Explain the block diagram and working of an instrumentation amplifier.	(16)	3	BTL 4	Analyzing
16.	Summarize the importance of high input impedance and CMRR in instrumentation amplifiers.	(16)	3	BTL 4	Analyzing
17.	Compare instrumentation amplifiers with operational amplifiers.	(16)	3	BTL 3	Applying

UNIT IV – TRANSDUCERS FOR MEASUREMENT OF NON-ELECTRICAL PARAMETERS

Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors.

PART A

Q.No	Questions	CO	BT Level	Competence

1.	Define a transducer.		4	BTL 1	Remembering
2.	Classify transducers based on principle of operation.		4	BTL 1	Remembering
3.	What is an active transducer?		4	BTL 1	Remembering
4.	What is a passive transducer?		4	BTL 1	Remembering
5.	Differentiate between active and passive transducers.		4	BTL 2	Understanding
6.	What is meant by pressure measurement?		4	BTL 1	Remembering
7.	Name any two pressure transducers.		4	BTL 1	Remembering
8.	State the principle of piezoelectric pressure transducer.		4	BTL 2	Understanding
9.	What is temperature measurement?		4	BTL 1	Remembering
10.	List any two temperature transducers.		4	BTL 1	Remembering
11.	State the working principle of RTD.		4	BTL 2	Understanding
12.	What is meant by displacement measurement?		4	BTL 1	Remembering
13.	Define LVDT.		4	BTL 1	Remembering
14.	State the principle of LVDT.		4	BTL 2	Understanding
15.	What is flow measurement?		4	BTL 1	Remembering
16.	Name any two flow transducers.		4	BTL 1	Remembering
17.	What is angular velocity measurement?		4	BTL 1	Remembering
18.	Mention one transducer used for angular velocity measurement.		4	BTL 2	Understanding
19.	What are digital transducers?		4	BTL 1	Remembering
20.	State one advantage of digital transducers.		4	BTL 2	Understanding
21.	What is a smart sensor?		4	BTL 1	Remembering
22.	List any two features of smart sensors.		4	BTL 2	Understanding
23.	What is signal conditioning?		4	BTL 1	Remembering
24.	Mention any one application of transducers in industry.		4	BTL 2	Understanding
	PART B				
1.	Explain the classification of transducers with suitable examples.	(16)	4	BTL 3	Applying
2.	Explain the construction and working of pressure transducers.	(16)	4	BTL 3	Applying
3.	Analyze the advantages and limitations of piezoelectric pressure transducers.	(16)	4	BTL 4	Analyzing

4.	Explain the working principle of temperature transducers such as RTD and thermocouple.	(16)	4	BTL 3	Applying
5.	Describe the selection criteria for temperature transducers.	(16)	4	BTL 4	Analyzing
6.	Explain the construction and working of LVDT for displacement measurement.	(16)	4	BTL 3	Applying
7.	Generalize the performance characteristics of LVDT.	(16)	4	BTL 4	Analyzing
8.	Explain different methods of flow measurement using transducers.	(16)	4	BTL 3	Applying
9.	Analyze the errors involved in flow measurement techniques.	(16)	4	BTL 4	Analyzing
10.	Explain the methods used for angular velocity measurement.	(16)	4	BTL 3	Applying
11.	Illustrate the tachogenerator-based angular velocity measurement.	(16)	4	BTL 4	Analyzing
12.	Explain the working of digital transducers with block diagram.	(16)	4	BTL 3	Applying
13.	Evaluate the advantages of digital transducers over analog transducers.	(16)	4	BTL 4	Analyzing
14.	Explain the concept and architecture of smart sensors.	(16)	4	BTL 3	Applying
15.	Analyze the role of smart sensors in modern measurement systems.	(16)	4	BTL 4	Analyzing
16.	Explain the need for signal conditioning in transducer-based systems.	(16)	4	BTL 3	Applying
17.	Discuss the application of non-electrical transducers in automation systems.	(16)	4	BTL 4	Analyzing

UNIT V - DIGITAL INSTRUMENTATION

A/D converters: types and characteristics – Sampling, Errors- Measurement of voltage, Current, frequency and phase - D/A converters: types and characteristics- DSO- Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation - Instrument standards.

PART A

Q.No	Questions	CO	BT Level	Competence

1.	Define digital instrumentation.		5	BTL 1	Remembering
2.	What is an A/D converter?		5	BTL 1	Remembering
3.	List the types of A/D converters.		5	BTL 1	Remembering
4.	Define resolution of an A/D converter.		5	BTL 1	Remembering
5.	What is meant by sampling?		5	BTL 1	Remembering
6.	State the Nyquist sampling theorem.		5	BTL 2	Understanding
7.	What is quantization error?		5	BTL 1	Remembering
8.	Mention any two errors in A/D conversion.		5	BTL 2	Understanding
9.	What is a digital voltmeter (DVM)?		5	BTL 1	Remembering
10.	How is current measured using digital instruments?		5	BTL 2	Understanding
11.	What is frequency measurement?		5	BTL 1	Remembering
12.	Define phase measurement.		5	BTL 1	Remembering
13.	What is a D/A converter?		5	BTL 1	Remembering
14.	List the types of D/A converters.		5	BTL 1	Remembering
15.	Define settling time of a D/A converter.		5	BTL 1	Remembering
16.	What is a Digital Storage Oscilloscope (DSO)?		5	BTL 1	Remembering
17.	Mention any two advantages of DSO over CRO.		5	BTL 2	Understanding
18.	What is a data logger?		5	BTL 1	Remembering
19.	State one application of data loggers.		5	BTL 2	Understanding
20.	What is PLC?		5	BTL 1	Remembering
21.	Mention any two components of a PLC.		5	BTL 1	Remembering
22.	What is virtual instrumentation?		5	BTL 1	Remembering
23.	State one advantage of virtual instrumentation.		5	BTL 2	Understanding
24.	What are instrument standards?		5	BTL 1	Remembering
	PART B				
1.	Explain the working principle of A/D converters with classification.	(16)	5	BTL 3	Applying
2.	Explain successive approximation type A/D converter with block diagram.	(16)	5	BTL 3	Applying
3.	Analyze the characteristics of A/D converters.	(16)	5	BTL 4	Analyzing

4.	Explain the sampling process and sampling theorem in digital instrumentation.	(16)	5	BTL 3	Applying
5.	Illustrate the various errors associated with A/D conversion.	(16)	5	BTL 4	Analyzing
6.	Explain the digital measurement of voltage and current.	(16)	5	BTL 3	Applying
7.	Describe the methods of digital frequency measurement.	(16)	5	BTL 4	Analyzing
8.	Explain the digital measurement of phase.	(16)	5	BTL 3	Applying
9.	Explain the working principle of D/A converters with types.	(16)	5	BTL 3	Applying
10.	summarize the performance characteristics of D/A converters.	(16)	5	BTL 4	Analyzing
11.	Explain the construction and working of a Digital Storage Oscilloscope (DSO).	(16)	5	BTL 3	Applying
12.	Generalize the advantages and limitations of DSO.	(16)	5	BTL 4	Analyzing
13.	Explain the working principle of data loggers.	(16)	5	BTL 3	Applying
14.	Evaluate the role of data loggers in industrial monitoring.	(16)	5	BTL 4	Analyzing
15.	Explain the basic architecture and programming concepts of PLC.	(16)	5	BTL 3	Applying
16.	Analyze the importance of virtual instrumentation in modern measurement systems.	(16)	5	BTL 4	Analyzing
17.	Discuss instrument standards and their role in ensuring measurement accuracy.	(16)	5	BTL 4	Analyzing

COURSE OUTCOMES

1. To acquire knowledge on fundamental art of measurement in engineering.
2. To understand the concepts of structural elements of various instruments.
3. Ability to the importance of bridge circuits.
4. To acquire knowledge about various transducers and their characteristics by experiments.
5. To understand the concept of digital instrumentation and virtual instrumentation by experiments.