

## LIST OF EQUIPMENTS

### FOR THE BS IN ELECTRICAL ENGINEERING PROGRAM

#### I- ALLIED COURSES

#### ELECTRONIC CIRCUITS: DEVICES AND ANALYSIS

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: Item No. (from 2020 Inventory)
1. Diode Characteristics	DC Power Supply	Available	9, 14,15
	Digital Multimeter (DMM)	Available	10
	Breadboard	Available	14,17, 36, 37,38
	Oscilloscope	Available	13, 33
	Desktop Computer	Available	30
2. The Diode Limiter, Diode Clamper, Rectifiers and Filters, Voltage Doubler	Function Generator	Available	12, 40
	Semiconductor Devices	Available	14,17, 36, 37, 38
	Circuit Board with Power Supply	Available	14,17, 36, 37,38
	Oscilloscope	Available	13,33
	Digital Multimeter (DMM)	Available	10
	Desktop Computer	Available	30
3. Zener Diode and Voltage Regulation	Digital Multimeter (DMM)	Available	10
	Breadboard	Available	14,17, 36, 37,38
	Semiconductor Devices	Available	37
	Circuit Board with Power Supply	Available	14,17, 36, 37,38
	DC Supply	Available	9,1 4, 15
	Desktop Computer	Available	30
4. BJT Characteristics and Biasing	Digital Multimeter (DMM)	Available	10
	Semiconductor Devices	Available	14,36
	Circuit Board with Power Supply	Available	14,17, 36, 37,38
	Desktop Computer	Available	30
5. Small-signal Amplifier a. Common-Base b. Common-Emitter c. Common-Collector	Digital Multimeter	Available	10
	Transistor Amplifier	Available	14,17, 36, 37, 38
	Circuit Board with Power Supply	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
6. JFET Amplifier	Digital Multimeter (DMM)	Available	10
	FET Fundamentals	Available	14,36
	Circuit Board with Power Supply	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
7. BJT/JFET Frequency Response	Digital Multimeter (DMM)	Available	10
	Transistor Power Amplifier	Available	14,17, 36, 37, 38
	Circuit Board	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
8. BJT/JFET Frequency Response	Digital Multimeter (DMM)	Available	10
	Transistor Power Amplifier	Available	14,17, 36, 37, 38
	Circuit Board	Available	14,17, 36, 37,38

	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
9. Cascaded Amplifier	Digital Multimeter (DMM)	Available	10
	Transistor Amplifier	Available	14,17, 36, 37, 38
	Circuit Board	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
10. Power Amplifier	Digital Multimeter (DMM)	Available	10
	Transistor Power Amplifier	Available	14,17, 36, 37,38
	Circuit Board	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
11. Differential Amplifier, Inverting/Noninverting Operational Power Amplifiers, Operational Amplifier Applications	Digital Multimeter	Available	10
	Function Generator	Available	12, 40
	Digital Oscilloscope	Available	13, 33
	Operational Amplifier	Available	14,17, 36, 37,38
	Circuit Board	Available	14,17, 36, 37,38
12. Feedback Amplifier	Digital Multimeter	Available	10
	Transistor Feedback Circuit	Available	14,17, 36, 37,38
	Circuit Board	Available	14,17, 36, 37,38
	Function Generator	Available	12, 40
	Oscilloscope	Available	13, 33
13. Square Wave Oscillators	Digital Multimeter	Available	10
	DC Power Supply	Available	9, 14,15
	Digital Oscilloscope	Available	13, 33
	Breadboard	Available	14,17, 36, 37,38
14. Familiarization with Digital Circuits	DC Power Supply	Available	9, 14,15
	VOM	Available	10
	Digital Oscilloscope	Available	13, 33
	Digital Circuit Training Board	Available	15, 18, 35,39

### INDUSTRIAL ELECTRONICS

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: Item No. (from 2020 Inventory)
1. Filters	Filter Experimental Module	Available	38
	Oscilloscope	Available	13, 33
	Multimeter	Available	10
	DC Supply	Available	9, 14,15
	Function Generator	Available	12, 40
2. Voltage Multipliers	(same with 1)	Available	(same with 1)
3. Voltage Regulator	(same with 1)	Available	(same with 1)
4. DC Characteristics of Thyristors and other Switching Devices, Thyristors and Phase	Multimeter	Available	10
	Oscilloscope	Available	13, 33
	Signal Generator	Available	12, 40
	Regulated, variable DC power	Available	9, 14,15

Control Circuits	supply		
	SCRs	Available	14,36,38
	TRIACs	Available	14,36,38
	UJTs	Available	14,36,38
	Capacitors	Available	not listed
	Resistors	Available	not listed
	Potentiometers	Available	not listed
	Breadboard	Available	14,17, 36, 37,38
	SPST Switches	Available	38
	Lamp	Available	38
	DC Motor	Not Available	n/a
5. Optoelectronics Devices	Oscilloscope	Available	13, 33
	Function Generator	Available	12, 40
	Multimeter	Available	10
	LED	Available	38
	Laser Diode	Available	38
	Photodiode	Available	38
	Photodetector	Available	38
	Power Supply	Available	9, 14,15
6. Transducers and Transmitters	Multimeter	Available	10
	Oscilloscope	Available	13, 33
	Signal Generator	Available	12, 40
	Regulated, variable DC supply	Available	9, 14,15
	Transducer and Transmitter Training Module	Available	38
7. Programmable Controllers-PLC Basics	PC Workstation	Available	30
	PLC Training Module with simulation software for PLC	Available	31,41
8. PLC timers, counters, and applications	(same with 7)	Available	(same with 7)

## II- PROFESSIONAL COURSES

### ELECTRICAL CIRCUITS I

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: Item No. (from 2020 Inventory)
1. Familiarization with electrical measuring instruments and devices	Circuit Training Kit/Module	Available	14,15,37
	Analog/digital Multimeter	Available	10
	Analog/digital milliammeter	Not Available	n/a
	Analog/digital ammeter	Available	10
	Analog/digital voltmeter	Available	10
	Variable/regulated power supply	Available	9, 14,15
	Analog/digital wattmeter	Not Available	n/a
	Rheostat (variable resistor)	Available	14
2. Design of voltage divider circuits	Multimeter	Available	10
	DC ammeter	Available	10
	DC voltmeter	Available	10

	Variable/fixed DC regulated power supply	Available	9, 14,15
	Calibrated potentiometer	Available	14
	Variable resistive load	Not Available	n/a
	Connecting wires	Available	not listed
3. Complete response of first-order dynamic circuits	Computer system	Available	30
	Computer-aided circuit analysis software	Available	53
4. Voltage-current relationships in resistive, inductive, and capacitive circuits with sinusoidal excitation	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Function generator	Available	12, 40
	Dual trace oscilloscope	Not Available	(dual trace oscilloscope is an old, bulky, analog oscilloscope; digital is available)
	Variable resistive load	Not Available	n/a
	Variable inductive load	Not Available	n/a
	Variable capacitive load	Not Available	n/a
5. At least two design experiments on selected topics	Connecting wires	Available	not listed
	Combination of existing lab apparatus, instruments, devices;	Available	all listed
	Available freeware for circuit analysis (capable of doing DC analysis, transient analysis, AC analysis )	Available	53 (or freeware like PSPICE)

## ELECTRICAL CIRCUITS 2

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: Item No. (from 2020 Inventory)
1. Design and applications of impedance bridge circuits	AC ammeter	Available	10
	AC voltmeter	Available	10
	Function generator	Available	12, 40
	Calibrated potentiometer	Available	not listed
	Variable resistor	Available	not listed
	Variable inductor/capacitor	Available	not listed
	Inductive load	Available	not listed
	Capacitive load	Available	not listed
2. Power in AC circuits, maximum power transfer principle	Connecting wires	Available	not listed
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Function generator	Available	12, 40
	Wattmeter	Not Available	n/a
	Variable resistive, inductive, capacitive load	Available	14,15,37
3. Power factor correction	Connecting wires	Available	not listed
	(same with 2)	(same with 2)	(same with 2)

4. Series-tuned and parallel-tuned circuits	AC ammeter	Available	10
	AC voltmeter	Available	10
	Function generator	Available	12, 40
	Variable resistor	Available	14,15,37
	Variable inductor	Available	14,15,37
	Variable capacitor	Available	14,15,37
	Connecting wires	Available	not listed
5. Two-port network analysis of RLC circuits	Circuit Training Kit/Module	Available	14,15,37
	Analog/digital multimeter	Available	10
	AC milliammeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Function generator	Available	12, 40
	Variable resistor, variable resistive load	Not Available	n/a
	Variable inductive load	Available	14,15,37
	Variable capacitive load	Available	14,15,37
	Connecting wires	Available	not listed
6. Voltage and current relationships in balanced three-phase systems	Three-phase power supply	Not Available	n/a
	Analog/Digital multimeter	Available	
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Fixed resistor, inductor and capacitor	Available	Three-phase power supply
	Connecting wires	Available	not listed
7. Power measurement in balanced three-phase, 3-wire and 4-wire systems	Three-phase power supply	Not Available	n/a
	Analog/Digital multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Single-phase wattmeter	Not Available	n/a
	Lamp loads	Available	not listed
	3-phase inductive load	Not Available	n/a
	Connecting wires	Available	not listed
8. Analysis of three-phase systems with unbalanced loading	Three-phase power supply	Not Available	n/a
	Analog/Digital multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Single-phase wattmeter	Not Available	n/a
	Single-phase inductive load	Not Available	n/a
	Single-phase capacitive load	Not Available	n/a
	Lamp load	Available	not listed
	3-phase inductive load	Not Available	
	Connecting wires	Available	not listed
9. Power factor correction in three-phase systems	Three-phase power supply	Not Available	
	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Variable capacitor	Available	not listed
	3-phase inductive load	Not Available	
	Connecting wires	Available	not listed
10. Analysis of circuits	AC power supply	Available	n/a

with magnetically coupled-coils	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Rheostat	Available	not listed
	Two-winding transformer	Not Available	
	Variable-resistive load	Available	not listed
	Connecting wires	Available	not listed
11. At least four design experiments on selected topics	Combination of existing lab apparatus, instruments, devices	Available	all listed
	Available freeware for circuit analysis (capable of doing DC analysis, transient analysis, AC analysis)	Available	53 (or freeware like PSPICE), 50

### AC APPARATUS AND DEVICES

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: <u>Item No. (from 2020 Inventory)</u>
1. Characteristic tests of a single-phase two-winding transformer: polarity test, open circuit test, short circuit test	Single-phase AC power supply	Available	n/a
	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Wattmeter	Not Available	n/a
	Variable autotransformer (VARIAC)	Not Available	n/a
2. Voltage regulation and efficiency of a transformer	connecting wires	Available	not listed
	Single-phase AC power supply	Available	n/a
	Multimeter	Available	10
	Variable autotransformer (VARIAC)	Not Available	n/a
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Power factor meter	Not Available	n/a
	Two-winding transformer	Not Available	n/a
	Variable resistive load	Not Available	n/a
	Variable inductive load	Not Available	n/a
	Variable capacitive load	Not Available	n/a
3. Conversion of a two-winding transformer into an autotransformer	Connecting wires	Available	not listed
	Single-phase AC power supply	Available	n/a
	Multimeter	Available	10
	Variable autotransformer (VARIAC)	Not Available	n/a
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Two-winding transformer	Not Available	n/a
	Not Available	n/a	Not Available
	Not Available	n/a	Not Available
Not Available	n/a	Not Available	

	Connecting wires	Available	not listed
4. Parallel operation of a single-phase transformer	Single-phase AC power supply	Available	n/a
	Multimeter	Available	10
	Variable autotransformer (VARIAC)	Not Available	n/a
	AC voltmeter	Available	10
	Power factor meter	Not Available	
	Two-winding transformer	Not Available	n/a
	Variable resistive load	Not Available	n/a
	Variable inductive load	Not Available	n/a
	Variable capacitive load	Not Available	n/a
	Connecting wires	Available	not listed
5. The three-phase transformer and the three-phase transformer bank	Three-phase power supply	Not Available	n/a
	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Three-phase transformer	Not Available	n/a
	Single-phase two winding transformer	Not Available	n/a
	Three-phase inductive load	Not Available	n/a
	Connecting wires	Available	not listed
6. The open delta or V-V connection of single-phase transformers	Three-phase power supply	Not Available	n/a
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Single-phase two winding transformer	Not Available	n/a
	Three-phase inductive load	Not Available	n/a
	Connecting wires	Available	not listed
7. The Scott-connection or T-T connection of two single-phase transformers	Three-phase power supply	Not Available	n/a
	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Single-phase two winding transformer (with 50% and 86.6% taps on both primary and secondary)	Not Available	n/a
	Three-phase inductive load	Not Available	n/a
	Connecting wires	Available	not listed
8. Parallel operation of three-phase transformers or three-phase banks	Three-phase power supply	Not Available	n/a
	Multimeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Power factor meter	Not Available	n/a
	Three-phase transformer	Not Available	n/a
	Single-phase two-winding transformer	Not Available	n/a
	Three-phase inductive load	Not Available	n/a
	Connecting wires	Available	not listed

## ELECTRIC MACHINES 2

<b>Recommended Laboratory Exercises</b>	<b>Required Equipment/Apparatus</b>	<b>STATUS</b>	<b>Supporting Document: Item No. (from 2020 Inventory)</b>
1. Familiarization with electromechanical energy conversion equipment	DC compound machine	Not Available	n/a
	Multimeter	Available	10
	Cage rotor induction machine	Not Available	n/a
	Slip ring machine	Not Available	n/a
	DC ammeter	Available	10
	DC voltmeter	Available	10
	Rheostat	Available	not listed
	DC power supply	Available	9, 14,15
	Connecting wires	Available	not listed
2. Characteristics of the DC shunt, series, compound motor	Multimeter	Available	10
	DC compound machine	Not Available	n/a
	DC power supply	Available	9, 14,15
	DC ammeter	Available	10
	DC voltmeter	Available	10
	Torque meter	Not Available	n/a
	Rheostat	Available	not listed
	Variable resistive load	Not Available	n/a
	General purpose rheostat	Available	not listed
Connecting wires	Available	not listed	
3. Parallel operation of DC generators	Multimeter	Available	10
	DC compound machine	Not Available	n/a
	DC power supply	Available	9, 14,15
	DC ammeter	Available	10
	DC voltmeter	Available	10
	Rheostat	Available	not listed
	Variable resistive load	Not Available	n/a
	General purpose rheostat	Available	not listed
Connecting wires	Available	not listed	
4. The squirrel-cage induction motor (SCIM) and the wound-rotor induction motor	Cage-rotor induction machine	Not Available	n/a
	Slip ring machine	Not Available	n/a
	Three-phase power supply	Not Available	n/a
	Multimeter	Available	10
	AC voltmeter	Available	10
	AC ammeter	Available	10
	AC wattmeter	Not Available	n/a
	Torque meter	Not Available	n/a
	Connecting wires	Available	not listed
5. The synchronous motor	Slip-ring machine	Not Available	n/a
	DC power supply	Available	9, 14,15
	DC compound machine	Not Available	n/a
	DC voltmeter	Available	10
	Three-phase power supply	Not Available	n/a
	AC voltmeter	Available	10
	AC ammeter	Available	10
	AC wattmeter	Not Available	n/a
Torque meter	Not Available	n/a	



	Variable resistive load	Not Available	n/a
	Connecting wires	Available	not listed
	Multimeter	Available	10
6. External characteristics of a three-phase alternator	Slip ring machine	Not Available	n/a
	DC compound machine	Not Available	n/a
	DC power supply	Available	9, 14,15
	Rheostat	Available	not listed
	AC voltmeter	Available	10
	AC ammeter	Available	10
	DC voltmeter	Available	10
	Wattmeter	Not Available	n/a
	Variable resistive load	Not Available	n/a
	Three-phase resistive load	Not Available	n/a
	Three-phase inductive load	Not Available	n/a
	Three-phase capacitive load	Not Available	n/a
	Connecting wires	Available	not listed
	Multimeter	Available	10
7. Synchronization and parallel operation of three-phase alternators	Slip ring machine	Not Available	n/a
	DC compound machine	Not Available	n/a
	DC power supply	Available	9, 14,15
	Rheostat	Available	not listed
	Direct-on-line starter	Available	not listed
	Synchroscope	Not Available	n/a
	DC ammeter	Available	10
	DC voltmeter	Available	10
	AC ammeter	Available	10
	AC voltmeter	Available	10
	Variable resistive load	Not Available	n/a
	Three-phase resistive load	Not Available	n/a
	Phase sequence indicator	Not Available	n/a
	Data management system	Not Available	n/a
Connecting wires	Available	not listed	
Multimeter	Available	10	
8. At least two design experiments to illustrate the industrial applications of AC machines	Available freeware for analysis of AC machine characteristics and performance	Available	50,53, PSPICE

### INSTRUMENTATION AND CONTROL

Recommended Laboratory Exercises	Required Equipment/Apparatus	STATUS	Supporting Document: <u>Item No.</u> (from 2020 Inventory)
1. Measurement of Electric and Magnetic Quantities and analysis of measurement error	Adjustable DC power supply	Available	9, 14,15
	Oscilloscope with connectors	Available	13, 33
	Digital multi-meter	Available	10
	VOM	Available	10
	RLC meter	Not Available	n/a
	Power meter	Not Available	n/a
	Signal Generator	Available	12, 40

2. Sensors, transducers, transmitters, and actuators	Experimental module for sensors, transducers, transmitters, and actuators	Available	14,15,37,38
3. Data acquisition, ADC/DAC conversion, signal conditioning, recording and retrieval	Training module for analog, data acquisition, conversion, and digital data recording and retrieval	Available	15,17,18,35,37,38,39
4. Temperature Measurement	Temperature control training module	Available	37,38
5. Measurement of Pressure	Pressure control training module	Available	37,38
6. Measurement of flow rate and liquid level	Flow rate and level measurement training module	Not Available	n/a
7. On-off Control	On-off control training module	Available	38
8. PID control	PID controller training module	Available	38