higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

REPORT 191 PROGRAMMES

SYLLABUS

INDUSTRIAL ELECTRONICS

N5

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CONTENTS **PAGE**

1. General aims 3
2. Specific aims 3
3. Pre-requisite 3
4. Duration 3
5. Evaluation 3
6. Learning content 4
7. Mark allocation in the examination as an indication of the weighting of the different modules 4
Module 1: Alternating Current Theory 5
Module 2: Power supplies 7
Module 3: Amplifiers 11
Module 4: Integrated circuits and Transducers 15
Module 5: Electronic Phase Control 18
Module 6: Measuring Instruments 19
Module 7: Oscillators 20

Syllabus: Industrial Electronics N5

1. General Aims

To equip students with knowledge and fundamental principles in the electronic industry in order to improve their work skills and further their career prospects.

2 Specific Aims

2.1 The student should obtain a thorough knowledge of principles and practices as applied in the electronics industry.

2.2.1 The teaching of this subject is aimed as an introduction to the application of technological principles and practices such as:

- Power Supplies and Control
- Design procedures
- Process Control
- Amplification
- Integrated circuits
- Transducers

3. Pre-requisite

3.1 Students must have at least completed National N4 certificate with Industrial Electronics.

4. Duration

Full-time: 7.5 hours per week. This instructional offering may also be offered in part-time basis.

5. Evaluation

5.1 Evaluation is conducted continuously by means of two formal tests at college level. Student must obtain a minimum ICASS mark of at least 40% in order to qualify to write the final examination and a mark will be calculated together in a ratio of 30:70 to derive the promotion mark. The student must obtain at least 40% on the final examination as pass mark.

The promotion mark will be calculated as follows:
Promotion Mark **= 30%** of (ICASS mark) **+ 70%** of (Exam mark)

5.2 The examination in Industrial Electronics N4 (Engineering Studies - Report 191) will be conducted as follows:

Modules 1 to 7 MARKS: 100

DURATION: 3 HOURS

CLOSED BOOK: Formula sheet is attached to the question paper.
Scientific calculators allowed.
No programmable calculators allowed
No references allowed.
No external examination papers or memoranda allowed.

5.3 **Weighting**:

The following weights are consequently awarded to each category:

Knowledge and understanding	**Applying**	**Analysing / Syntheses and Evaluating**
30 – 40	45 – 50	10 – 25

6. Learning content

THEORETICAL BACKGROUND

It is essential that this subject should be illustrated and evaluated within the context of practical case studies.

7. Mark allocation in the examination as an indication of the weighting of the different modules

MODULES	WEIGHTING
1. Alternating Current Theory	**15**
2. Power Supplies	**15**
3. Amplifiers	**15**
4. Integrated circuits and Transducers	**15**
5. Electronic phase control	**10**
6. Measuring instrument	**10**
7. Oscillators	**10**
8. Liquid crystal display	**10**
TOTAL	**100**

Module 1: Alternating current theory.

General aim

On completion of this module, the student should learn about alternating current theory in terms of circuit diagrams, definitions, operating principles, graphical representation, and complex calculations.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
1.1 RL and RC circuits	1.1.1 Draw labelled circuit diagrams inclusive of the input and output waveforms of the following: - The RC differentiator - The RC integrator - The RL differentiator - The RL integrator
1.2 RC differentiator	1.2.1 Briefly explain the term RC differentiator. 1.2.2 Explain the operating principle of RC differentiator. 1.2.3 List the applications and characteristics of RC differentiator. 1.2.4 List, explain or draw neatly labelled diagram of different types of waveforms of RC differentiator. 1.2.5 Explain the operating principle of RC differentiator as a high pass filter. 1.2.6 Calculate the RC differentiator Input and output voltages, capacitance of the capacitor, current, resistance of the resistor, the rate of change of input and output voltage and time constant.
1.3 RC integrator	1.3.1 Briefly explain the term RC integrator. 1.3.2 Explain the operating principle of RC integrator. 1.3.3 List the applications and characteristics of RC integrator. 1.3.4 Draw a neatly labelled RC integrator frequency response curve. 1.3.5 Explain the operating principle of RC differentiator as a low pass filter. 1.3.6 Calculate the RC integrator rate of change of input and output voltage, capacitance of the capacitor, resistance of the resistor, voltage, current, time constant and the charge of the capacitor

1.4 RL Differentiator	1.4.1 Briefly explain the term RL differentiator. 1.4.2 Explain the operating principle of RL differentiator. 1.4.3 List the applications and characteristics of RL differentiator. 1.4.4 Draw neatly labelled diagram of different types of waveforms of an RL differentiator. 1.4.5 Calculate the RL differentiator Input and output voltages, inductance of the inductor, current, voltage, resistance of the resistor, the time rate of change of the current, and time constant
1.5 RL Integrator	1.5.1 Briefly explain the term RL integrator. 1.5.2 Explain the operating principle of RL integrator. 1.5.3 List the applications and characteristics of RL integrator. 1.5.4 Draw a neatly labelled waveforms representation, effects of various time constants on a square wave of RL integrator. 1.5.5 Calculate the RL integrator rate of change of input and output voltage, inductance of the inductor, resistance of the resistor, voltage, current, and time constant
1.6 Capacitive Coupling	1.6.1 Explain the following with the aid of a neatly labelled circuit diagram: • Coupling capacitor • Series-coupling capacitor connection • High pass filter / CR coupling 1.6.2 Explain the term Capacitive coupling. 1.6.3 List applications of Capacitive coupling 1.6.4 List the advantages and disadvantages of Capacitive coupling
1.7 Harmonics	1.7.1 Explain in brief the term Harmonics. 1.7.2 Draw a neatly labelled square waveform and its harmonics. 1.7.3 List and explain the different types of the waves. 1.7.4 Explain what type of waveform and harmonics the following waves consists of: • Square wave • Saw-tooth. • Triangular wave 1.7.5 Show by means of a neat, labelled waveform the difference between odd harmonics and even harmonics. 1.7.6 Explain the difference between symmetrical waveforms and non-symmetrical waveform and give examples for each. 1.7.7 Explain in words the low-pass filters pass DC, low-frequency harmonics and high pass filter.

1.8 RLC circuit	1.8.1 Analyse RL, RC, RLC, and LC circuits / phasor diagrams to calculate the following values by applying complex numbers or j notation in series, parallel / series-parallel circuits: • Voltage • Current • Total impedance • Total power • Power factor • Phasor angle • Inductive and • Capacitive reactance
1.9 Resonance	1.9.1 Calculate the following values by using the given information in a series / parallel resonance circuit: • Resonance frequency • Dynamic impedance • Current at resonance • The voltage • Total current • The Q-factor • The bandwidth • Capacitive and inductive reactance • Capacitance of the capacitor • Inductance of the inductor 1.9.2 Explain the following terms in words: - Series and parallel resonance frequency - Q factor - Bandwidth - Upper frequency harmonics 1.9.3 Indicate the difference in high and low selectivity and bandwidth by means of a neatly labelled amplitude-response curve versus a frequency-response curve. 1.9.4 Calculate the value of the Q factor, the bandwidth, upper/high and lower power frequencies.

Module 2: Power Supplies
General aim

On completion of this module the student should be able to understand the operating principle, draw circuit diagrams and provide input and output waveforms of filters in half-wave and full-wave rectifiers, filters, voltage doublers and tripplers.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
2.1 Typical power Supply	2.1.1 Draw a neatly labelled block diagram of that contains components of a power supply. 2.1.2 Explain the operating principle of a typical power supply.
2.2 Transformer and sine wave	2.2.1 Draw a neatly labelled circuit symbol of a transformer. 2.2.2 Draw a neatly labelled sine wave. 2.2.3 Make use of the sine wave calculation to calculate form factor and peak factor. 2.2.4 Make use of the transformer ratios to calculate the following: • Turns ratio • Voltage ratio and • Current ratio
2.3 Rectification	2.3.1 Explain in words the term rectification. 2.3.2 Explain what a rectifier and its operating principle is. 2.3.3 List the THREE rectifier circuits available. 2.3.4 Explain in words the term rectification efficiency.
2.4 Half-wave Rectification	2.4.1 Draw a neatly labelled circuit diagram of a half-wave rectifier and show its input and output waveforms. 2.4.2 Explain the operating principle of a half-wave rectifier. 2.4.3 Calculate the following values using the given information of a half-wave rectifier: V_{DC}, I_M, I_{DC}, V_M, V_{MAX}, V_{RMS}, Resistance, Peak inverse voltage (PIV), output frequency and Power. 2.4.4 List the advantages and disadvantages of a half-wave rectifier. 2.4.5 Calculate the efficiency and DC power delivered to the 2.4.6 load of a half-wave rectifier circuit. Explain in words the following terms • Ripple • Ripple factor 2.4.7 Calculate the ripple factor of a half-wave rectifier.
2.5 Full-wave Rectification	2.5.1 Explain in words the term full-wave rectifier. 2.5.2 List the two types of full-wave rectifier circuits. 2.5.3 Draw a neatly labelled circuit diagram of a centre-tap full-wave rectifier circuit and clearly show their input and output waveforms. 2.5.4 Explain the operating principle of a centre-tap full-wave rectifier circuit. 2.5.5 Draw a neatly labelled circuit diagram of a bridge full-wave rectifier circuit and clearly show their input and output waveforms. 2.5.6 Explain the operating principle of a bridge full-wave rectifier circuit. 2.5.7 Calculate the following values using the given information of a centre-tap / bridge full-wave rectifiers:

	V_{DC}, I_M, I_{DC}, V_M, V_{MAX}, V_{RMS}, Resistance, Peak inverse voltage (PIV), Power, efficiency, output frequency and ripple factor. 2.5.8 List the differences between Bridge and Centre-tap circuits.
2.6 Filters	2.6.1 Explain in words the term filter. 2.6.2 List and draw the labelled circuit diagrams of different types of filter circuits and clearly show their input and output waveforms. 2.6.3 Explain the operating principle of half-wave rectifier with capacitor filter during the positive / negative half circuits. 2.6.4 Explain the operating principle of a centre-tap / bridge full-wave rectifier with shunt-capacitor filter circuits. 2.6.5 List the advantages and disadvantages of a simple capacitor filter. 2.6.6 Calculate the following values using the given information of a half-wave, centre-tap / bridge full-wave rectifiers with shunt-capacitor filter: V_{DC}, I_M, I_{DC}, V_M, V_{MAX}, $V_{r(RMS)}$, $V_{r(rms)}$, $V_{r(p-p)}$, Resistance of the load, capacitance of the capacitor, Peak inverse voltage (PIV), Power, efficiency, ripple factor and ripple factor (at f=50Hz). 2.6.7 Explain the operating principle of half-wave / full-wave rectifier with series inductor filter. 2.6.8 List the advantages and disadvantages of a full-wave rectifier with series inductor filter. 2.6.9 Calculate using the information given by a FWR with a series inductor filter circuit the following values: - V'_{DC} - Resistance - Resistance of the load - Ripple factor - Inductance of the inductor 2.6.10 Explain in words what is a choke or LC-input filter circuit. 2.6.11 Explain the operating principle of a choke or LC-input filter circuit. 2.6.12 List the advantages and disadvantages of choke or LC-input filter circuit. 2.6.13 Explain in words what is an LC π filter circuit. 2.6.14 Explain the operating principle of an LC π filter circuit. 2.6.15 List the advantages and disadvantages of LC π filter circuit. 2.6.16 Explain in words what is an RC π filter circuit. 2.6.17 Explain the operating principle of an RC π filter circuit. 2.6.18 List the advantages and disadvantages of RC π filter circuit. 2.6.19 Calculate the following values using the given information of an LC / RC π filter circuits for either half-wave or full-wave rectifier: V'_{DC}, V_{DC}, I_M, I_{DC}, V_M, V_{MAX}, $V'_{r(rms)}$, $V_{r(rms)}V_R$, Resistance of the load, capacitance of the capacitor, capacitive and

	inductive reactance, Peak inverse voltage (PIV), Power, efficiency, ripple and ripple factor(r').
2.7 Voltage doubler and Tripler	2.7.1 List and explain the operating principles of two main types of voltage doublers. 2.7.2 Draw a neat, labelled circuit diagram of the voltage doublers. 2.7.3 Explain the operating principle and draw a neat, labelledcircuit diagrams of a half-wave voltage Tripler.
2.8 Voltage regulation	2.8.1 Explain in words the term voltage regulation. 2.8.2 Draw a neatly labelled circuit diagram of a regulating power supply. 2.8.3 Draw a neatly labelled circuit diagram of a voltage regulating curve. 2.8.4 Explain in words the following terms: - Load regulation - Line regulation 2.8.5 Calculate the following using the information available for the regulating power supply: - Voltage regulation - Voltage at no load - Voltage at full load - Percentage voltage regulation - Line regulation
2.9 Voltage regulating Circuits	2.9.1 Explain the operating principle of a voltage regulator circuit and list its application. 2.9.2 Draw a neatly labelled block diagram of a regulated power supply. 2.9.3 Explain the operating principle of a zener diode as a voltage reference. 2.9.4 Draw a neat, labelled circuit diagram of a zener diode used a s a reference element. 2.9.5 Explain the operating principle of a transistor voltage regulator circuit and list its application. 2.9.6 List two types of transistor voltage regulators and draw neatly labelled block diagram for each. 2.9.7 List the four major elements of transistor voltage regulators. 2.9.8 Explain the operating principle of the following voltage regulator circuits: - Series voltage regulator - Series feedback voltage regulator - Basic op-amp series regulator - Adjustable series regulator 2.9.9 Draw a neat, labelled circuit diagram of the following voltage regulator circuits: - Series voltage regulator - Series feedback voltage regulator - Basic op-amp series regulator - Adjustable series regulator 2.9.10 List the purpose of voltage regulating protective circuits.

	2.9.11 Explain the operating principle and draw neatly labelled circuit diagrams for the following voltage regulation protection circuits: - Short-circuit, overload or overcurrent protection. - Over voltage protection - Series voltage regulator with over current protection 2.9.12 Explain in words what a shunt voltage regulator is and list its application. 2.9.13 List, explain the operating principles and draw a neat labelled circuit diagram of different types of shunt voltage regulator. 2.9.14 List the drawbacks of the shunt voltage regulator. 2.9.15 Draw a neat, labelled circuit diagram of a shunt feedback voltage regulator. 2.9.16 Explain the operating principle of a shunt feedback voltage regulator. 2.1.17 Explain the operating principle of a dual power supplies and list its application. 2.1.18 Draw a neat, labelled circuit diagram of a dual voltagepower supplies.

Module 3: Amplifiers

General aim

On completion of this module the student should be able to know the properties, operating principles and draw graphical representation of CE amplifiers.
To understand the basics and the benefits of operational amplifiers. All these concepts and methods will help in designing and utilising operational amplifiers.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
3.1 Transistors	3.1.1 Explain in words the term biasing. 3.1.2 Explain the main reason for biasing of circuits. 3.1.3 Explain the following terms: - Forward biasing - Reverse biasing 3.1.4 List THREE most commonly used methods of obtaining transistor biasing. 3.1.5 Explain in words the term stabilisation. 3.1.6 List the TWO points where the collector current in a transistor changes rapidly. 3.1.7 List and explain in words the THREE points why there is a need for stabilisation of the operating point. 3.1.8 Draw neatly labelled circuit diagrams of thefollowing fixed bias circuits. - Fixed bias circuit - Self-bias circuit - Voltage divider bias circuit 3.1.9 List the advantages and disadvantages of fixedbiasing. 3.1.10 Calculate the following values using the informationgiven of a fixed bias CE circuits and draw the load line: V_{CC}, V_{RB}, V_{BE}, I_B, R_B, R_C, I_C, V_{CE}, V_{RC} and β 3.1.11 Calculate the component values for a single stage CE amplifier. 3.1.12 Draw a neat, labelled circuit diagram of a voltage divider biascircuit. 3.1.13 Explain in words the following term Hybridparameters and give its purpose.

	3.1.14 Draw neatly labelled diagrams and know the equations of the following hybrid / h-parameters. - Linear circuit - Output short circuited - Input open circuited - H-parameter equivalent circuit 3.1.15 Draw a neat, labelled circuit diagrams of the followingtransistor amplifier using h-parameter equivalent circuits: - Basic amplifier circuit - Small signal of hybrid Model of transistor amplifier circuit - General amplifier circuit - Hybrid equivalent circuit 3.1.16 Calculate using the precise and approximate method the following values: - Current gain - Input impedance - Voltage gain - Output impedance - Power gain
3.2 Operational Amplifiers	3.2.1 Explain in words the operating principle of operational amplifiers and their applications. 3.2.2 List and draw a neatly labelled diagram of different examples of an op-amp pin-out configurations or packages. 3.2.3 List and explain in words the characteristic of an ideal versus real op-amp. 3.2.4 Draw a neat, labelled block diagram of internalconstruction of an operational amplifier. 3.2.5 List the THREE stages of operational amplifier. 3.2.6 Explain in words the term deferential amplifier. 3.2.7 Draw a neat, labelled block / circuit diagram of differential amplifier. 3.2.8 List TWO ways how a signal can be applied to a differential amplifier. 3.2.9 List TWO ways how an output can be taken from a differentiator amplifier. 3.2.10 Explain the operating principle and draw the neatly labelled circuit diagrams of differential amplifier for both single-ended input and double-ended input. 3.2.11 Explain the operating principle and draw the neatly labelled circuit diagrams of non-inverting and inverting input. 3.2.12 List, explain the operating principles and draw neatly waveforms of signals.

	3.2.13 List two differential inputs that can simultaneously receive two signals and draw their neatly circuit diagrams and show their input and output waveforms. 3.2.14 List and explain the operating principle of voltage gain of differential amplifier. 3.2.15 Explain the operating principle of input / output offset voltage and draw their neatly labelled circuit diagram. 3.2.16 Calculate the following values of input / output offset voltage: • Input voltage • Output voltage (offset) • Voltage gain 3.2.17 Explain the operating principle and draw a neatly circuit diagram of input bias current. 3.2.18 calculate the following values of input bias current. • Input bias current • Base current1 and base current 2 3.2.19 Explain in words the operating principle of an operational amplifier. 3.2.20 Draw a neat circuit diagram of an operational amplifier. 3.2.21 Explain the operating principle of a non-inverting / inverting, draw their neatly labelled circuit diagrams, show their waveforms. 3.2.22 List, explain the operating principle and draw the neat, labelled circuit diagram for different types of operational amplifiers. 3.2.23 Calculate the following values of inverting / inverting amplifiers: • Output voltage • Feedback resistance • Input resistance • Input voltage • Voltage gain 3.2.24 Calculate the following values of summing amplifier: • Voltages (V_1, V_2 and V_3) • Output voltage • Resistance (R_1, R_2 and R_3) • Feedback resistance • Currents (I_1, I_2 and I_3) 3.2.25 Calculate the following values of subtractor or difference amplifier: • Voltages (V_1, V_2 and V_3) • Output voltage • Resistance (R_1, R_2 and R_3) • Feedback resistance • Feedback current • V_x

	3.2.26 Calculate the following values of voltage follower amplifier: • Output voltage • Input voltage • Voltage gain 3.2.27 Calculate the following values of integrator amplifier: • Rate of change of output voltage • Input voltage • Capacitance of the capacitor • Input resistance • Critical frequency • Feedback resistance 3.2.28 Calculate the following values of differentiator amplifier: • Output voltage • Input voltage • Resistance • Capacitance of the capacitor 3.2.29 Explain in words the term filters. 3.2.30 List, explain the operating principles and draw neat labelled circuit / block diagrams or characteristic curves of different types of filters. 3.2.31 Explain the difference between passive and active filters. 3.2.32 Explain what is meant by the term first and second order filters. 3.2.33 Calculate the following values using information given by active low filter with amplification: • Cut-off frequency • Resistance of the resistor • Capacitance of the capacitor 3.2.34 Calculate the following values using information given by second-order low/high pass active filter, first order active high pass filter or active high pass filter with amplification: • Voltage gain • Resistance of the resistors (R_1, R_2, R_3, R_4) • Capacitance of the capacitors (C_1, C_2) • Cut-off frequency

Module 4: Integrated Circuits and Transducers

General aim

On completion of this module the student should be able to understand operating principle, circuit diagrams and list various types of transducers and integrated circuits.

LEARNING CONTENT	LEARNING OUTCOMES **The student must be able to:**
4.1 Integrated circuit	4.1.1 Explain in words the term integrated circuit. 4.1.2 List the functions / applications where integrated circuits are used. 4.1.3 List, explain the operating principles and application of different types of integrated circuit packages. 4.1.4 Explain in words the term integrated bridge rectifiers. 4.1.5 List different types of bridge rectifier packages. 4.1.6 List the advantages and disadvantages of integrated bridge rectifier. 4.1.7 Explain in words the term integrated circuit voltage regulator. 4.1.8 List the advantage of integrated circuit voltage regulator. 4.1.9 List and explain the functions different types of IC voltage regulator. 4.1.10 Explain the operating principle and draw a neat labelled circuit diagram of 7812 voltage regulator. 4.1.11 Explain in words the term electrostatic discharge. 4.1.12 Explain the operating principle of electrostatic discharge fundamentals. 4.1.13 Explain in brief how does damage from electrostatic discharge happen. 4.1.14 List and explain the modes in which ESD damage occurs. 4.1.15 Explain in words the term ESD sensitivity. 4.1.16 Explain in words how you should handle circuits boards.

	4.1.17 List precautionary measures that can be taken into consideration when handling CMOS chips or MOSFET transistors.
4.2 Transducers	4.2.1 Explain in words the term Transducer. 4.2.2 List the points to be considered when selecting a transducer. 4.2.3 List the requirements a transducer must meet to ensure reliable operation of a control system. 4.2.4 Draw a neatly block diagram of how transducers can be classified. 4.2.5 List and explain the functions of TWO types of transducers. 4.2.6 List the types of passive transducers. 4.2.7 Explain in words what is meant by the term potentiometer. 4.2.8 Explain the operating principle of a potentiometer. 4.2.9 List, explain the operating principles or circuit diagrams applications and draw a neatly labelled circuit diagrams / construction of the potentiometric displacement transducers. 4.2.10 Explain in words what is meant by the term potentiometer resolution. 4.2.11 Calculate the following values of potentiometer resolution: • Percentage resolution • Voltage difference of two adjacent turns. • Total voltage • Total number of turns 4.2.12 List the different areas of application for a potentiometer resolution. 4.2.13 Explain in words the following terms: • Stress • Strain 4.2.14 Explain in words the term strain gauge. 4.2.15 Draw a neatly labelled construction of a strain gauge. 4.2.16 Explain the operating principle of strain gauge. 4.2.17 Explain in words the term gauge factor. 4.2.18 Calculate the following values of a strain gauge: • Original resistance of the strain gauge • Elongation or construction-initiated resistancechange • Length of the resistance wire • Change in length of the resistance wire. • Proportional constant • Strain 4.2.19 List the factors that affect the gauge. 4.2.20 Explain the operating principle and draw a neatly labelled circuit diagram of a strain gauge used in a Wheatstone bridge.

	4.2.21 Explain in words the term thermistor. 4.2.22 Explain operating principle and draw a neatly labelled construction of a thermistor. 4.2.23 Calculate the following values given by thermistor: • A and B are constant • The base of the Naperian logarithms • Temperature in degree Kelvin 4.2.24 List two ways that a Wheatstone bridge thermistor can be used. 4.2.25 List, explain the operating procedure, functions, applications and draw neatly labelled circuit / block diagrams / construction of the following transducers: • Inductive transducers • Voltage and current transducers • Photo-electric transducers

Module 5: Electronic Phase Control

General aim

On completion of this module the students should be able understand the operating principle of Thyristors used in a single-phase system.

LEARNING CONTENT	**LEARNING OUTCOMES** **The student must be able to:**
5.1 SCR	5.1.1 List and explain in words the methods on how an SCR can be switched on. 5.1.2 List and explain in words the methods on how an SCR can be switched off. 5.1.3 List and explain in words the methods on how the TRIAC can be switched off. 5.1.4 Explain in words the difference between an SCR and a TRIAC.

	5.1.6 List, explain the operating principles and draw neatly labelled circuit diagrams of ways in which an SCR can be triggered. 5.1.7 Explain with the aid of a neatly labelled circuit diagram / waveform of a DC phase control and state its operating procedure. 5.1.8 Explain with the aid of a neatly labelled circuit diagram / waveform the types of full-wave DC phase control and state its operating procedure. 5.1.9 List, explain the operating procedures and draw a neatly labelled circuit diagrams / waveforms of different types of AC phase control. 5.1.10 List and explain different terminologies used to control systems. 5.1.11 Draw a neatly labelled block diagram of a control system and explain its operating principles. 5.1.12 List, explain operating procedures and draw neatly labelled diagrams of two categories of control systems. 5.1.13 Explain the operating principles and draw circuit diagrams showing the input and output waveforms of a half / full wave phase control. 5.1.14 List, explain the operating principles, applications and draw a neatly labelled circuit / block diagrams of the closed loo phase control systems and an SCR-controlled close loop system.

Module 6: Measuring Instrument

General aim

On completion of this module the students should be able to have the knowledge and understanding of how to use analog and digital measuring instruments in electronic industry

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
6.1 Analogue and digital signal	6.1.1 Explain in words what is meant by the term analogue signal. 6.1.2 Draw a neat diagram of an analogue signal. 6.1.3 Explain in words what is meant by the term digital signal. 6.1.4 Draw a neat diagram of a digital signal. 6.1.5 Explain the reason why we convert from analogue to digital and which device is used? 6.1.6 List names, purpose and characteristics of circuits used in measuring instruments. 6.1.7 Explain the operating principle and draw a neatly block diagram of a frequency counter. 6.1.8 Explain in words the term digital voltmeter. 6.1.9 List, explain the operating principle and draw neatly labelled block diagram / waveforms of different digital voltmeters.

Module 7: Oscillators

General aim

On completion of this module the student should be able to know and understand the basic operating principle of oscillators.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
7.1 Oscillation	7.1.1 Explain the difference between amplifier and oscillation and also draw a neat block diagram of this difference. 7.1.2 Explain the basic principle of oscillators. 7.1.3 Draw neatly labelled diagram of the following: • Input signal plus feedback signal generates an output signal. • Only feedback signal generated 7.1.4 Explain how oscillation are produced in an LC circuit and calculate oscillation frequency. 7.1.5 List and explain the factors that affect theoscillation frequency. 7.1.6 Explain the operating principle and draw neatly labelled circuit diagrams of the following types of oscillators namely: • Colpitts • Hartley • Crystal-controller • Phase shift • Wein bridge 7.1.7 Explain in words the term multivibrator. 7.1.8 Describe the operation of transistor multivibrators monostable, astable, bistable Schmitt trigger circuit. 7.1.9 List applications of multivibrators. 7.1.10 Draw a neatly labeled circuit diagram of different multivibrator circuit. 7.1.11 Explain the operation of a 555 timer in astable and monostable mode. 7.1.12 Draw neatly labeled circuit diagram of 555 timers in monostable and astable. 7.1.13 Calculate the frequency of square wave given by the reciprocal of the time period for a rectangular waveform.

Module 8: Liquid Crystal Display

General aim

On completion of this module the student should be able to know and understand the basic operating principle of Liquid Crystal Display.

LEARNING CONTENT	LEARNING OUTCOMES The student must be able to:
8.1 Liquid Crystal Display	8.1.1 List advantages of LCD 8.1.2 List advantages of LCD 8.1.3 List factors that should be taken into consideration when constructing an LCD. 8.1.4 Explain the operating principle of an LCD. 8.1.5 Draw a neatly labelled diagram of an LCD.