

Branch

CHEMICAL

Semester

6

Course Code

Course Name

CHEMICAL ENGINEERING
INSTRUMENTATION

Course Outcome 1	Apply basic principle of measurements in chemical processes	Teach Hrs	Marks
Learning Outcome 1	Identify measurement techniques for various process variables	8	15
Contents	Importance of instrumentation & control in processing industries. Measurements and measuring instruments. Methods of measurements. Direct and indirect measurement. Elements of an instruments: primary , secondary, manipulating and functioning elements, Functions of instruments: different functions of an instruments such as Transmitting, Indicating ,recording, registering etc: their meaning and importance. Detector transducer element, classification of transducer, Primary & secondary transducer, mechanical transducer, electrical transducer, transducer description, transducer sensitivity, selection of an instrument transducer, variable resistance transducer, variable inductance transducer, thermo electric transducer, capacitive transducer, piezo electric transducer, photo electric transducer.		
Method of Assessment	Theory Exam(external)		
Learning Outcome 2	Classify instruments according to their function in chemical industry	12	15
Contents	Classification of instruments: Absolute and secondary instruments. Power operated and self-operated instruments. Manual & Automatic instruments .Digital & Analog mode. Self-contained & remote indicating, Characteristics of an instrument: Static characteristics: Ra range and span, Accuracy, static error and correction, Calibration and calibration curve, reproducibility and Drift: zero span & point drift Sensitivity & dead zone, hysteresis, linearity, overall system sensitivity Threshold and resolution, Precision, repeatability, and Linearity, Dynamic characteristics: Standard test inputs .Speed of response & measuring lag, Fidelity & dynamic error, overshoot, Dead time and dead zone, Order and response of an instrument.		

Method of Assessment	Theory Exam(external)		
Learning Outcome 3	Determine error and necessary correction for an instrument	9	10
Contents	determination of static error and corresponding static correction and to plot calibration curve for different types of instruments		
Method of Assessment	Laboratory test by observations(external)		
Course Outcome 2	Use temperature measuring instruments for appropriate industrial application.		
Learning Outcome 1	Use expansion thermometers in appropriate situation .	8	15
Contents	Expansion Thermometers: Types of expansion thermometers, Mercury in glass thermometer, other liquids used in thermometer with their ranges, high temperature measurement and over range protection, Dip effect Pressure spring thermometers, Pneumatic pressure thermometers, static error and compensation, Bimetallic thermometers		
Method of Assessment	Theory Exam(external)		
Learning Outcome 2	Use electrical properties of materials to measure temperature	11	20
Contents	Thermocouples: Thermoelectricity, Seeback effect,Peltier effect and Thomson effect, .laws of thermoelectric circuits, Working principle and application of industrial thermocouples, Thermocouple lead wires,Thermal well, Thermocouple circuits Mili voltmeter circuit and Null potentiometer circuit Resistance thermometers Working principle, construction and application. resistance thermometer circuits:- Wheatstone bridge, Callendar Griffiths bridge circuit,		
Method of Assessment	Theory Exam(external)		
Learning Outcome 3	Operate pyrometer for given application	07	10
Contents	Radiation thermometer, Principle, construction and application of radiation thermometer, Radiation receiving elements,Lens type and mirror type radiation pyrometer Principle and working of optical pyrometer Photoelectric pyrometer		

Method of Assessment	Theory Exam(external)		
Learning Outcome 4	Choose the relevant instrument to measure temperature of the given system with justification	12	20
Contents	To determine the temperature using different types of thermometers		
Method of Assessment	Laboratory test by observations(external)		
Course Outcome 3	Use relevant instrument for measuring pressure and vacuum in chemical industry		
Learning Outcome 1	Select suitable instrument for measuring differential, gauge pressure and vacuum.	13	20
Contents	Measurement of pressure and vacuum: Manometers: construction , working principle advantages and disadvantages of U tube ,inclined leg ,differential and enlarged leg manometer. Measuring elements for gauge pressure, Differential pressure and vacuum, Bourdon tube Diphragm and bellows, Simple bellow and double bellow working of pressure gauges Measurement of Vacuum: Pirani gauge ,Mcloid gauge and ionization gauge, Indicating elements for measuring gauges		
Method of Assessment	Theory Exam(external)		
Learning Outcome 2	Operate appropriate pressure measuring device in the given situation	9	20
Contents	Operation of different types of manometers, pressure gauges and vacuum gauges		
Method of Assessment	Laboratory test by observations. (external)		
Course Outcome 4	Apply appropriate method for level, density and composition analysis in process		
Learning Outcome 1	Select suitable method for level measurement in process industry	6	20
Contents	Instruments for measuring liquid level in open vessel and Closed vessel by direct and indirect method . float and tape, float and shaft method, bubbler system, diaphragm box method, air trap method, Measurement of interface level.		
Method of Assessment	Theory Exam (internal)		
Learning Outcome 2	Select suitable method for density measurement in process industry	4	10
Contents	Density and specific gravity measurement, liquid level method, Hydro-meter method, Displacement method		

Method of Assessment	Theory exam (internal)		
Learning Outcome 3	Select correct method for composition analysis in chemical industries.	8	15
Contents	Composition analysis 1 Brief treatment of absorption, Emission and mass, spectroscopy, Beers law, Working principle of gas chromatograph, Thermal conductivity method, Ph meter, Humidity measurement by Hygrometer and Psychrometer		
Method of Assessment	Theory Exam (External)		
Learning Outcome 4	Use appropriate method for level, density and composition analysis in process industry.	9	20
Contents	Extraction: Definition, Difference between leaching & extraction, Comparison with distillation as a separation operation, Fields of application of extraction, Desirable characteristics of solvent for extraction, Selectivity and distribution coefficient with respect to extraction, Representation of ternary system on triangular diagram		
Method of Assessment	Laboratory test by observations (external)		
Course Outcome 5	Evaluate the performance of control system with appropriate controllers and control valves.		
Learning Outcome 1	Explain different elements for open loop and closed loop system	11	15
Contents	Control system and elements, Block Diagram, description of block diagram, On off control, feed back and feed forward control Open and Close loop system , servo and regulating problem Proportional, Proportional integral, Proportional derivative and Proportional integral derivative controllers, Reset, rate control and rate control characteristics, Application and concept of automatic control for batch and continuous processes, Elementary idea about pneumatic, electrical and hydraulic controllers		
Method of Assessment	Theory Exam (External)		
Learning Outcome 2	use control system in industries.	6	10
Contents	Study of level control loop system and temperature control loop system		
Method of Assessment	Laboratory test by observations (external)		

**FORMAT 4
DETAILED COURSE PLAN**

RGPV(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code	Course code	CO code 1	LO code 1
		C 0			

Course name: Chemical Engineering Instrumentation

CO description: Apply basic principle of measurements in chemical processes.

LO description: Identify measurement techniques for various process variables.

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract /Tut Hrs	LRS Required	Remarks
1.	Importance of instrumentation & control in processing industries. Measurements and measuring instruments. Methods of measurements. Direct and indirect measurement. Elements of an instruments: primary , secondary, manipulating and functioning elements, Functions of instruments: different functions of an instruments such as Transmitting, Indicating ,recording, registering etc: their meaning and importance. Detector transducer element, classification of transducer, Primary & secondary transducer, mechanical transducer, electrical transducer, transducer description, transducer sensitivity, selection of an instrument transducer, variable resistance transducer, variable inductance transducer, thermo electric transducer, capacitive transducer, piezo electric transducer, photo electric transducer.	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	8	2	Suggested textbook handouts powerpoint	

Scheme of assessment

S. No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	15	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code			Course code			CO code 1	LO code 2
		C	0	2					

Course name: Chemical Engineering Instrumentation

CO description: Apply basic principle of measurements in chemical processes.

LO description: Classify instruments according to their function in chemical industry.

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tu t Hrs	LRS Required	Remarks
1.	<p>Classification of instruments: Absolute and secondary instruments. Power operated and self-operated instruments. Manual & Automatic instruments .Digital & Analog mode. Self-contained & remote indicating, Characteristics of an instrument: Static characteristics: range and span, Accuracy, static error and correction, Calibration and calibration curve, reproducibility and Drift: zero span & point drift Sensitivity & dead zone, hysteresis, linearity, overall system sensitivity Threshold and resolution, Precision, repeatability, and Linearity, Dynamic characteristics: Standard test inputs .Speed of response & measuring lag, Fidelity & dynamic error, overshoot, Dead time and dead zone, Order and response of an instrument.</p>	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	10	2	Suggested textbook handouts powerpoint	

Scheme of assessment

S. No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	15	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code			Course code	CO code 1	LO code 3
		C	0	2			

Course name: Chemical Engineering Instrumentation

CO description: Apply basic principle of measurements in chemical processes.

LO description: Determine error and necessary correction for an instrument.

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tut Hrs	LRS Required	Remarks
1.	determination of static error and corresponding static correction and to plot calibration curve for different types of instruments.	Lab - demonstration	Faculty will explain the content in lab and demonstrate how to take reading		9	Experiment Setup Lab Manual	

Scheme of assessment

S. No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1.	Laboratory Test by observation	Examiner will ask to students to take reading and then calculate in front of him and will asses correctness of result	10	Rating scale	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code			Course code	CO code	LO code
		C	0	2			

Course name: Chemical Engineering Instrumentation

CO description: Use temperature measuring instruments for appropriate industrial application

LO description: Use expansion thermometers in appropriate situation.

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Prac t/Tu t Hrs	LRS Required	Remarks
1.	Expansion Thermometers: Types of expansion thermometers, Mercury in glass thermometer, other liquids used in thermometer with their ranges, high temperature measurement and over range protection, Dip effect Pressure spring thermometers, Pneumatic pressure thermometers, static error and compensation, Bimetallic thermometers	Traditional Lecture Method	Teacher will explain the contents and provide handouts to students. Teacher will conduct assignments /quiz/ tutorial to make students practice their knowledge.	06	02	Handouts Chalk board, PPT text board.	

Scheme of assessment

S. No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1.	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	15	Question Paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma a Wing& Bhopal	Scheme for learning outcome	Branch code			Course code	CO code 2	LO code 2
		C	0	2			

Course name: Chemical Engineering Instrumentation

CO description: Use temperature measuring instruments for appropriate industrial application

LO description: Use electrical properties of materials to measure temperature

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Prac t/Tu t Hrs	LRS Required	Remar ks
1.	Thermocouples: Thermoelectricity, Seeback effect, Peltier effect and Thomson effect, .laws of thermoelectric circuits, Working principle and application of industrial thermocouples, Thermocouple lead wires, Thermal well, Thermocouple circuits Mili voltmeter circuit and Null potentiometer circuit Resistance thermometers Working principle, construction and application. resistance thermometer circuits:- Wheatstone bridge, Callendar Griffiths bridge circuit,	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	8	3	Suggested textbook handouts powerpoint	

Scheme of assessment

S. No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	20	Question Paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code			Course code	CO code	LO code
		C	0	2			

Course name: Chemical Engineering Instrumentation

CO description: Use temperature measuring instruments for appropriate industrial application.

LO description: Operate pyrometer for given application.

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Prac t/Tu t Hrs	LRS Required	Remar ks
1.	Radiation thermometer Principle, construction and application of radiation thermometer, Radiation receiving elements, Lens type and mirror type radiation pyrometer Principle and working of optical pyrometer Photoelectric pyrometer	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	5	2	Suggested textbook handouts powerpoint	

Scheme of assessment

S. No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	10	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing&)Bhopal	Scheme for learning outcome	Branch code			Course code	CO code 2	LO code 4
		C	0	2			

Course name: Chemical Engineering instrumentation

CO description: Use temperature measuring instruments for appropriate industrial application.

LO description: Choose the relevant instrument to measure temperature of the given system with justification

Scheme of study

S.No.	Learning content	Teaching learning method	Description of TL process	Teach H Hrs.	Pract/Tut Hrs	LRS Required	Remarks
1.	To determine the temperature using different types of thermometers.	Lab – demonstration	Faculty will explain the content in lab and demonstrate how to take reading		12	Experiment Setup Lab Manual	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1.	Laboratory Test by observation	Examiner will ask to students to take reading and then calculate in front of him and will assess correctness of result	20	Rating scale	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diploma Wing&)Bhopal	Scheme for learning outcome	Branch code			Course code			CO code 3	LO code 1
		C	0						

Course name: Chemical Engineering Instrumentation

CO description: Use relevant instrument for measuring pressure and vacuum in chemical industry.

LO description: Select suitable instrument for measuring differential, gauge pressure and vacuum.

Scheme of study

S.No	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tut Hrs	LRS Required	Remarks
1.	Measurement of pressure and vacuum: Manometers: construction , working principle advantages and disadvantages of U tube ,inclined leg ,differential and enlarged leg manometer. Measuring elements for gauge pressure, Differential pressure and vacuum, Bourdon tube Diphragm and bellows, Simple bellow and double bellow working of pressure gauges Measurement of Vacuum: Pirani gauge ,Mcloid gauge and ionization gauge, Indicating elements for measuring gauges.	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	10	3	Suggested textbook handouts powerpoint	

Scheme of assessment

S.No	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1.	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	20	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV(Diplom a Wing& Bhopal	Scheme for learning outcome	Branch code	Course code	CO code	LO code
		C 0 2		3	2

Course name: Chemical Engineering Instrumentation

CO description: Use relevant instrument for measuring pressure and vacuum in chemical industry.

LO description: Operate appropriate pressure measuring device in the given situation

Scheme of study

S. N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tu t Hrs	LRS Required	Remarks
1.	Operation of different types of manometers, pressure gauges and vacuum gauges	Lab - demonstration	Faculty will explain the content in lab and demonstrate how to take reading		9	Experiment Setup Lab Manual	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1.	Laboratory Test by observation	Examiner will ask to students to take reading and then calculate in front of him and will assess correctness of result	20	Rating scale	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGP V(Diploma Wing & Bhopal)	Scheme for learning outcome	Branch code			Course code			CO code			LO code		
		C	0	2				4			1		

Course name: Chemical Engineering Instrumentation

CO description: Apply appropriate method for level, density and composition analysis in process industry.

LO description: Select suitable method for level measurement in process industry.

Scheme of study

S.N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tut Hrs	LRS Required	Remarks
1.	Level Measurement : Instruments for measuring liquid level in open vessel and Closed vessel by direct and indirect method . float and tape, float and shaft method, bubbler system, diaphragm box method, air trap method, Measurement of interface level.	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	5	1	Suggested textbook handouts power point	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Pen paper test.	Theory question related to the learned content will be asked in the test paper	20	Test paper + Rating Scale	Internal

Additional instruction for the HOD/ faculty (if any)

Nil

RGP V(Diplom a Wing & Bhopal	Scheme for learning outcome	Branch code			Course code	CO code 4	LO code 2
		C	0	2			

Course name: Chemical Engineering Instrumentation

CO description: Apply appropriate method for level, density and composition analysis in process industry.

LO description: Select suitable method for density measurement in process industry.

Scheme of study

S.N	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/Tu t Hrs	LRS Required	Remarks
1.	Density and specific gravity measurement liquid level method, Hydro-meter method Displacement method	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	3	1	Suggested textbook handouts powerpoint	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Pen paper test.	Theory question related to the learned content will be asked in the test paper	10	Test paper + Rating Scale	Internal

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV (Diplo ma Wing & Bho pal	Scheme for learning outcome	Branch code			Course code			CO code 4	LO code 3
		C	0	2					

Course name: Chemical Engineering Instrumentation

CO description: Apply appropriate method for level, density and composition analysis in process industry.

LO description: Select correct method for composition analysis in chemical industries.

Scheme of study

S.No.	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pra ct/ Tut Hrs	LRS Required	Rema rks
1.	Composition analysis 1 Brief treatment of absorption, Emission and mass, spectroscopy, Beers law, Working principle of gas chromatograph, Thermal conductivity method, Ph meter, Humidity measurement by Hygrometer and Pschychrometer	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	6	2	Sugges ted textboo k handou ts power point	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resourc es required	Externa l /interna l
1.	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	15	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV (Diplo ma Wing &)Bho pal	Scheme for learning outcome	Branch code	Course code	CO code 4	LO code 4
		C 0 2			

Course name: Chemical Engineering Instrumentation

CO description: Apply appropriate method for level, density and composition analysis in process industry.

LO description: Use appropriate method for level, density and composition analysis in process industry.

Scheme of study

S.No.	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/ Tut Hrs	LRS Required	Remarks
1.	Measure level by Float type Level Meter and air purge method Measure density by Density Bottle and hydrometer method. Use of Spectrophotometer hygrometer and psychrometer	Lab - demonstration	Faculty will explain the content in lab and demonstrate how to take reading		9	Experiment Setup Lab Manual	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
1	Laboratory Test by observation	Examiner will ask to students to take reading and then calculate in front of him and will assess correctness of result	20	Rating scale	internal

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV (Diplo ma Wing &Bho pal	Scheme for learning outcome	Branch code			Course code			CO code 5	LO code 1
		C	0	2					

Course name: Chemical Engineering Instrumentation

CO description: Evaluate the performance of control system with appropriate controllers and control valves.

LO description: Explain different elements for open loop and closed loop system.

Scheme of study

S . N o .	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pra ct/ Tut Hrs	LRS Required	Rema rks
1	control system and elements Block Diagram, description of lock diagram On off control, feed back and feed forward control Open and Close loop system , servo and regulating problem Proportional, Proportional integral, Proportional derivative and Proportional integral derivative controllers Reset, rate control and rate control characteristics Application and concept of automatic control for batch and continuous processes Elementary idea about pneumatic, electrical and hydraulic controllers	Traditional Lecture Method	Faculty will explain learning content. To identify students weakness assignment will be given and accordingly remedial and tutorials will be taken.	8	3	Sugges ted textboo k handou ts powerp oint	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resourc es required	Externa l /interna l
1	Theory Exam	Theory questions related to the learned content will be asked in the university question paper	15	Question paper	External

Additional instruction for the HOD/ faculty (if any)

Nil

RGPV (Diplo ma Wing & Bho pal	Scheme for learning outcome	Branch code	Course code	CO code 5	LO code 2
		C 0 2			

Course name: Chemical Engineering Instrumentation

CO description: Evaluate the performance of control system with appropriate controllers and control valves.

LO description: use control system in industries.

Scheme of study

S.No.	Learning content	Teaching learning method	Description of TL process	Teach Hrs.	Pract/ Tut Hrs	LRS Required	Remarks
1.	Study of level control loop system and temperature control loop system	Lab - demonstration	Faculty will explain the content in lab and demonstrate how to take reading.		6	Experiment Setup Lab Manual	

Scheme of assessment

S.No.	Method of assessment	Description of assessment	Maximum marks	Resources required	External /internal
	Laboratory Test by observation	Examiner will ask to students to take reading and then calculate in front of him and will assess correctness of result	10	Rating Scale	External

Additional instruction for the HOD/ faculty (if any)

Nil

TENTATIVE LIST OF PRACTICALS

1. Calibration of Mercury in glass thermometer.
- 2 Calibration of Thermocouple thermometer.
- 3 Calibration of Thermocouple thermometer.
4. Study of different types of thermocouple and temperature measurement with them.
5. Temperature measurement with pressure spring thermometer.
6. Study of different types of pyrometer and temperature measurement with them.
7. Study of Mcloid gauge and vacuum measurement with it.
8. Study of Pirani gauge and vacuum measurement with it.
9. Study of Ionization gauge and vacuum measurement with them.
10. Level measurement by float and tap method.
11. Level measurement by float and shaft method.
12. Level measurement by air purge method.
13. Density measurement by hydrometer method.
14. Density measurement by density bottle method.
15. Determination of properties of air by psychrometer method.
16. Determination of properties of air by hygrometer method.
17. Determination of properties of air by psychrometer method.
- 18 Study of spectrophotometer with its application.
19. Study of temperature control loop.
20. Study of pressure control loop.
21. Study of level control loop.