Government Polytechnic Mumbai

Department of Instrumentation Engineering

P-19R Curriculum

Semester- III

(Course Contents)

GOVERNMENT POLYTECHNIC MUMBAI

(Academically Autonoums Institute, Government of Maharashtra)

Teaching and Examination Scheme (P19)

With effect from AY 2019-20

Programme: Diploma in Instrumentation Engineering (Sandwich Pattern) **Term / Semester - III**

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
							Theory			PR	OR	TW	Total
		L	P	TU	Total		TH	TS1	TS2				
IS19R203	Industrial Measurements	3	4	--	7	7	60	20	20	--	25*	25	150
IS19R208	Applied electronics	3	2	--	5	5	60	20	20	25	--	25	150
IS19R205	Control System Components	3	2	--	5	5	60	20	20	--	25*	25	150
IS19R210	Electrical Machines	3	2	--	5	5	60	20	20	25	--	25	150
IS19R207	Digital Techniques	--	4	--	4	4	--	--	--	50*	--	50	100
IS19R312	C and CPP (Spoken Tutorial)	--	4 #	--	4 #	4	--	--	--	--	--	--	--
UV19R103	Universal Human Values-III	--	---	---	2	2	--	--	--	--	--	--	--
	Total	**12**	**18**	**--**	**30**	**32**	**240**	**80**	**80**	**100**	**50**	**150**	**700**
Student Centered Activity(SCA)					**05**								
Total Contact Hours					**35**								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

***** Indicates assessment by External Examiner else internal assessment, **#** indicates Self, on- line learning Mode, **@** indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2:30 hours, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours

Self, on- line learning Mode through MOOCS /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Coordinator,
Curriculum Development,
Department of Instrumentation Engg.

In-Charge
Curriculum Development Cell

Head of Department
Department of Instrumentation Engg.

Principal

Programme : **Diploma in Instrumentation Engineering (Sandwich Pattern)**										
Course Code:IS19R203				Course Title: Industrial Measurements						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	**04**	**--**	**07**	**60**	**20**	**20**	**--**	**25***	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

In industry, Instrumentation engineering diploma graduates are expected to handle basic instruments for the measurements of various process parameters. The diploma graduates should be able to select proper instruments for the measurement of the parameters and maintain these instruments for different applications. This course mainly deals with study of various transducers as well as applications of measuring instruments.

Course Outcomes: Student should be able to

CO1	Demonstrate the operation of given displacement transducers.
CO2	Use the given pressure transducers to measure pressure.
CO3	Describe the working of given level transducers.
CO4	Explain the flow transducer application for measurement of flow.
CO5	Suggest a temperature transducer for an application.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Displacement Measurement** 1.1 Displacement – Definition, types & Units. 1.2 Resistive Displacement Transducers: Potentiometer, Strain gauge, types, Effect of temperature on strain gauge measurement, Simple Numerical on strain gauge factor. 1.3 Inductive Displacement transducers- Inductance principle, classification of inductive Transducers: LVDT, RVDT. 1.4 Capacitive Transducers- Capacitance principle, Concept & variable capacitance due to change in dielectric media, area of the plate, distance between the plates. 1.5 Displacement transducer selection criteria. (Diagram, construction, working, range, advantages, Disadvantages, and applications.) **Course Outcome: CO1 Teaching Hours : 08hrs Marks: 12 (R- 2, U-4, A-6)**

2	**Pressure Measurement** 2.1 Definition, different types of pressure. 2.2 Manometers: U-tube-type, well -type, inclined manometers, and barometer. 2.3 Elastic pressure sensors/ pressure gauges: Bourdon tubes, bellows, diaphragms. 2.4 Measurement of vacuum: McLeod gauge, thermal conductivity gauge, pirani gauge, thermocouple gauge. 2.5 Electronic pressure sensors: strain gauge-type, capacitive-type, inductive-type, and piezo-electric-type pressure sensors. 2.6 Differential pressure transmitter applications. 2.7 Calibration of pressure gauge using dead weight tester (Diagram, construction, operation, range, selection criteria, advantages, and applications and above pressure transducers.) **Course Outcome: CO2 Teaching Hours : 08hrs Marks: 12 (R- 2, U-4, A-6)**
3	**Level Measurement** 3.1 Sight-type Instruments: Glass gauges, displacers, tape float 3.2 Pressure-type Instruments: Differential pressure, bubblers, and Diaphragm. 3.3 Electrical- Instruments: Capacitance probes, resistance tapes, and conductivity probes. 3.4 Sonic- type Instruments: Ultrasonic –type level measurement 3.5 Radiation-type Instruments: Nuclear type ,Radar (microwave) type. 3.6 Level transducer selection criteria. (Diagram, construction, operation, range advantages, disadvantages & applications of above transducers.) **Course Outcome: CO3 Teaching Hours : 06hrs Marks: 10 (R- 2, U-4, A-4)**
4	**Flow Measurement** 4.1 Flow principles:Bernoulli's equation, Reynolds's number and flow types. 4.2 Flow-meters classification 4.3 Variable head flowmeters: Orifice plates, venturi-meter, flow nozzle, pitot tubes. 4.4 Variable area flowmeter: Rotameter. 4.5 Velocity-type flowmeters: Turbine-type, magnetic –type,vortex shedding type, ultrasonic type flow meters. 4.6 Positive-Displacement Flowmeters: Rotary-vane and Nutating-disk type flowmeters. 4.7 Corilios Mass flowmeters. 4.8 Flow meter selection criteria. (Diagram, construction, operation, range, advantages, disadvantages & applications of above transducers.) **Course Outcome: CO4 Teaching Hours : 12hrs Marks: 12 (R- 2, U-6, A-4)**
5	**Temperature Measurement** 5.1 Temperature: Definition, Temperature scales, International Practical Temperature Scale (IPTS). 5.2 Non electrical-type Temperature Measurement: Filled system thermometers, Bimetallic strip thermometers 5.3 Electrical -type Temperature Measurement: Resistance Temperature Detectors (RTDs), RTD measurementcircuits: 2 wire, 3wire and 4-wire compensation circuits. Thermistors, Thermocouples-Principle, thermocouple effects and laws, cold junction compensation techniques, Thermocouple tables, characteristics 5.4 Pyrometers: Radiation and optical Pyrometers.

	5.5 Integrated-Circuit Temperature Sensors. 5.6 Temperature transducer selection criteria. (Working Principle, construction, materials, range, Advantages, disadvantages, applications.) **Course Outcome: CO5 Teaching Hours : 11hrs Marks: 14 (R- 4, U-6, A-4)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Displacement Measurement**	2	4	6	12
2	**Pressure Measurement**	2	4	6	12
3	**Level Measurement**	2	4	4	10
4	**Flow Measurement**	2	6	4	12
5	**Temperature Measurement**	4	6	4	14
	Total	**12**	**24**	**24**	**60**

List of experiments: 15-20experiments (or turns) out of 33 experiments(or turns)

Sr. No.	Unit No	CO's	Title of the Experiments	Hours
1	1	CO1	Use the potentiometer to measure the linear displacement	2
2	2	CO2	To Measure Pressure using the given Bourdon Tubes– C type, Helical type or Spiral type	2
3	3	CO3	To measure water level using the given level transducers.	2
4	4	CO4	To measure Flow rate using given flow meter.	2
5	5	CO5	To plot the characteristics of PT-100 (Temp. Vs. Resistance)	2
6	1	CO1	Use the potentiometer to measure the angular displacement	2
7	1	CO1	Use the LVDT to measure linear displacement.	2
8	1	CO1	Use the RVDT to measure angular displacement.	2
9	1	CO1	To measure displacement using capacitive transducer	2
10	1	CO1	Micro project on displacement measuring instrument	4
11	1	CO1	Use the strain gauge to measure weights.	2
12	2	CO2	To Measure Pressure using the given well/ U-tube or inclined tube manometers	2
13	2	CO2	To observe Pressure measurement using the DP transmitter	2

14	2	CO2	To Measure vacuum using the given vacuum gauge.	2
15	2	CO2	To measure the pressure using given electronic pressure sensor/instrument.	2
16	2	CO2	To Calibrate the given pressure gauge by using dead weight tester	4
17	2	CO2	Micro project on pressure measuring instrument	4
18	3	CO3	To measure water level using the Bubbler method.	2
19	3	CO3	To measure water level using the given sight type instrument.	2
20	3	CO3	To measure level using conductivity probes instrument	2
21	3	CO3	To observe level measurement using sonic type instrument	2
22	3	CO3	To observe level measurement using radiation type instrument	2
23	3	CO3	To measure Level using the given DP transmitter.	2
24	3	CO3	Micro project on level measuring instrument	4
25	4	CO4	To measure Flow rate using orifice meter/venturimeter .	2
26	4	CO4	To measure Flow rate using Rotameter.	2
27	4	CO4	To measure Flow rate using DP transmitter.	2
28	5	CO5	To plot the characteristics of the given thermocouples (Temp. Vs. Voltage) J - type , K .	2
29	5	CO5	To plot the characteristics of the given thermocouples (Temp. Vs. Voltage) T - type, S and R - type .	2
30	5	CO5	To Plot the characteristics of a thermistor (Temp. Vs. Resistance**)**	2
31	5	CO5	To Calibrate the given temperature transducers.	2
32	5	CO5	Micro project on temperature measuring instrument.	4
33	All	All	Industrial visit	4
				60

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos.Remaining experiments are to be performed as per importanceof the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Measurement and Control Basics	Thomas A. Hughes, ISA Press, 5th Revised edition,2015	978-0876640142
2	Instrumentation Measurement and Analysis	B.C.Nakra, K.K.Chaudhari, Tata McGraw Hill,4th edition,,2016	9789385880629
3	Transducers and Instrumentation	D.V.S. Murthy, Prentice Hall India, 2 edition,2008	978-8120335691
4	Instrumentation Devices and Systems	C.S.Rangan , V.S.V. Mani , G.R. Sarma, Tata McGraw Hill, 2nd edition,2001	9780074633502
5	Industrial Instrumentation and control	S.K.Singh, Tata McGraw Hill,2 edition,2003	9780074519141
6	A Course in Electrical and Electronics Measurement and Instrumentation	A. K. Sawhney, DhanpatRai& Co,19th edition,2011	978-8177001006
7	Principles of Industrial Instrumentaion	D. Patranabis Tata McGraw Hill,2 edition,2001	9780074623343
8	Instrument Engineers Handbook Vol .Proecss Measurement	Bela G. Liptak Chilton Book Co U.S.A ,5th edition.2016	9781498727648

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1. https://nptel.ac.in/courses/103/105/103105130/
2. https://nptel.ac.in/content/storage2/courses/108105063/pdf/L0-6(SS)(IA&C)%20((EE)NPTEL).pdf
3. https://nptel.ac.in/courses/108/105/108105063/
4. www.youtube.com “enter the name of topic”

CO Vs PO and CO Vs PSOMapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	2	3	-	1	1	2	1
CO2	3	2	2	3	-	1	1	2	1
CO3	1	2	2	3	-	1	1	2	1
CO4	2	2	2	2	-	1	1	2	1
CO5	3	2	2	2	-	1	1	2	1

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr Sagar Panchal	Senior Engineer	VVF Ltd Taloja.
2	Mr. C.S. Tamkhane	Lecturer in Instrumentation	Govt. Polytechnic Pen
3	Mrs. K.U. Waghmare	Lecturer in Instrumentation Engg.	Govt. Polytechnic Mumbai
4	Mr. K. U. Dawane	Lecturer in Instrumentation Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Instrumentation Engg.

Head of Department
Department of Instrumentation Engg.

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Instrumentation Engineering (Sandwich Pattern)**										
Course Code: IS19R208				Course Title: Applied Electronics						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	**2**	**--**	**5**	**60**	**20**	**20**	**25**	**--**	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Instrumentation engineers deals with field data acquisition and control of parameters in industries. Data/signals are acquired in cotrol room from various sensors/ transducers and conditioned to required level and form. Based on these signal information the parmeters are controlled. Electronics and power circuits plays vital role in processing signals and controlling the parameters. This course deals with the maintenance of such electronics and power circuitaries in industries.

Course Outcomes: Student should be able to

CO1	Interpret different types of amplifiers
CO2	Demonstrate sine, square and pulse oscillators
CO3	Distinguish between various power electronics devices
CO4	Interpret different power conversion devices
CO5	Maintain power devices based basic control circuits

Course Content Details:

Unit No	Topics / Sub-topics
1	**Amplifiers** 1.1 Voltage amplifiers 1.1.1 Direct coupled 1.1.2 R-C coupled 1.1.3 Transformer coupled (circuit, operation and frequency response) 1.2 Negative feedback Amplifiers 1.2.1 Principle of negative feedback 1.2.2 Advantages of negative feedback 1.2.3 Voltage series feedback amplifier circuit & operation 1.2.4 Current series feedback amplifier circuit & operation 1.3 Power amplifiers 1.3.1 Classification

	1.3.2 Nonlinear distortion and efficiency of conversion 1.3.3 Push-pull amplifier 1.3.4 Complementry symmetry push-pull amplifier **Course Outcome: CO1 Teaching Hours : 12 Marks: 12 (R-04, U-04, A-04)**
2	**Oscillators** 2.1 Barkhausen criterion 2.2 RC phase shift oscillator 2.3 Weinbridge oscillator 2.4 Hartley oscillator 2.5 Colpit's oscillator 2.6 Crystal oscillator 2.7 Astable multivibrator 2.8 Monostable multivibrator 2.9 Bistable multivibrator 2.10 UJT relaxation oscillator (circuit, operation, equation for output frequency, no derivation) **Course Outcome: CO2 Teaching Hours : 08 Marks: 12 (R-02, U-06, A-04)**
3	**Power Devices** 3.1 SCR (Thyristor) 3.1.1 Symbol, construction, principle of operation, V-I characteristic 3.1.2 Turn On methods: R, RC triggering 3.1.3 Turn-off methods: load, line, external pulse, forced class C commutation 3.2 DIAC, TRIAC, IGBT, MOSFET 3.2.1 Symbol, construction, operation and V-I characteristic of DIAC, TRIAC, IGBT, MOSFET **Course Outcome: CO3 Teaching Hours : 08 Marks: 12 (R-02, U-06, A-04)**
4	**Power conversion** 4.1 Controlled Rectifiers 4.1.1 Single phase full controlled rectifier 4.1.2 Three phase full controlled rectifier 4.2 Chopper 4.2.1 Principle of operation 4.2.2 Control strategy: static and variable frequency system 4.2.3 Four quadrant chopper 4.3 Inverter 4.3.1 Single phase bridge inverter 4.3.2 Three phase 120˚ bridge inverter 4.3.3 Sinusoidal PWM inverter

	(circuit diagram, operation and application) **Course Outcome: CO4 Teaching Hours : 09 Marks: 12 (R-02, U-04, A-08)**
5	**Thyristor Applications** 5.1 Solid state relays 5.1.1 DC SSR 5.1.2 AC SSR 5.2 Triac based temperature control 5.3 Liquid level control using SCR 5.4 Triac based control for actuation of valves 5.5 Speed control of DC series motor with 1Ø full control converter 5.6 Speed control of 3Ø induction motor by v-f method (Circuit diagram, construction, operation and application only) **Course Outcome: CO5 Teaching Hours : 08 Marks: 12 (R-02, U-04, A-06)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Amplifiers**	04	04	04	12
2	**Oscillators**	02	06	04	12
3	**Power Devices**	02	06	04	12
4	**Power Conversion**	02	04	06	12
5	**Thyristor Applications**	02	04	06	12
	Total	**12**	**24**	**24**	**60**

List of experiments: Total 10-12 experiments(or turns) out of 15-16 experiments(or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To plot frequency response of RC-coupled amplifier.	2
2	2	CO2	To calculate the frequency of RC phase shift/ Wein bridge oscillators.	2
3	3	CO3	To plot the V-I characteristic of SCR. Measure Breakdown voltage, latching & holding current.	2
4	4	CO4	To observe/plot the output waveforms of single/three phase full controlled rectifier.	2
5	5	CO5	To test & observe the output for solid state relay.	2
6	1	CO1	To plot frequency response of transformer -coupled amplifier.	2

7	2	CO2	To calculate the frequency of Hartley/Colpit's oscillators.	2
8	3	CO3	To plot the V-I characteristic of DIAC. Measure Breakdown voltage, latching & holding current.	2
9	4	CO4	To observe/plot the output waveforms of four quadrant chopper.	2
10	5	CO5	To Test D.C motor speed control using chopper.	2
11	3	CO1	To perform Push pull amplifier and calculate its efficiency.	2
12	4	CO2	To perform Astable/ Bistable multivibrator and observe output waveforms.	2
13	5	CO3	To plot the V-I characteristic of TRIAC. Measure Breakdown voltage, latching & holding current.	2
14	3	CO4	To observe/plot the output waveforms of single-phase bridge inverter.	2
15	4	CO5	To construct TRIAC based temperature control circuit and test.	2
Total				**30**

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Electronic devices and Circuit Theory	R. Boylestad & L. Nasnlsky, Pearson Education India, 11th edition, 2015	978-9332542600
2	Electronic devices & Circuits : An Introduction	Allen Mottershed, PRENTICE HALL, 1st edition, 1979	978-8120301245
3	Electronic devices and Circuit Theory	J. Milman & C. C. Halkias, McGraw Hill Education, 1st edition, 1967	978-0070423800
4	Integrated Electronics	J. Milman, C. C. Halkias & Chetan Parikh, McGraw Hill Education; 2nd edition, 2017	978-0070151420
5	A Textbook of Electronic Devices and Circuits	R. S. Sedha, S. Chand publications, 2nd edition, 2008	978-8121928687
6	Power Electronics	P. S. Bimbhra, Khanna publishers, 6th edition, 1990	978-8174092793
7	Power Electronics Circuits Devices and Applications	Muhammad H. Rashid, Pearson Education, 4th edition, 2017	978-9332584587
8	Power Electronics	Singh M D and Khanchandani K.B., Tata Mcgraw Hill Publication, New Delhi, 2nd edition, 2017	978-0070583894

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1. https://nptel.ac.in/content/storage2/courses/
2. https://nptel.ac.in/courses/108/105/108105066/
3. https://vivadifferences.com/
4. https://www.tutorialspoint.com/
5. http://www.electronicshub.org/
6. http://electrofriends.com//
7. https://www.electrical4u.com/concept-of-power-electronics/
8. https://www.polytechnichub.com/

CO Vs PO and CO Vs PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1		2	2			1	2	
CO2	1		2	1			1	2	
CO3	1		1	2				2	
CO4	1		1	2				2	
CO5	1		2	1	2	2	2	2	1

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr.Santosh Kamble	Proprietor	Saitronics Pvt. Ltd, Kamothe, Navi Mumbai
2	Mr. Anil Gurav	Lecturer in Electronics Engg.	St. Xavier Technical Instt. Mahim, Mumbai
3	Mrs. K. U. Waghmare	Lecturer in Instrumentation Engg.	Government Polytechnic, Mumbai
4	Mr. F. S. Bagwan	Lecturer in Instrumentation Engg.	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Instrumentation Engg.

Head of Department,
Department of Instrumentation Engg.

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Instrumentation Engineering (Sandwich Pattern)**										
Course Code:IS19R205				Course Title: Control System Components						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2:30Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
03	**02**	**--**	**05**	**60**	**20**	**20**	**--**	**25***	**25**	**150**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

An Instrumentation diploma engineer has to deal with the testing, operation and maintenance of various control system components. This subject is introduced with the view that the students will get familiar with the operation of various systems such as pneumatic, hydraulic, and electrical and their basic components. This course will also help the students to understand the operation of different types of final control elements and auxiliary process control components.

Course Outcomes: Student should be able to

CO1	Operate the given hydraulic system component.
CO2	Demonstrate the operation given pneumatic component.
CO3	Use the control valve for an application.
CO4	Test the given electric control system component.
CO5	Demonstrate the working of given auxiliary process control component.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Hydraulic System Components:** 1.1. Introduction 1.2. Block diagram of Hydraulic system. 1.3. Applications of Hydraulic system. 1.4. Symbols of hydraulic components 1.5. Hydraulic pumps: Centrifugal pump, Reciprocating pump,Gear Pump,Vane Pump(construction and working) 1.6. Pressure regulation 1.7. Directional control valves: Check Valve, Spool valve,2/2, 3/2, 4/2, 4/3, 5/2 1.8. Pressure control valves: Direct type of relief valve, Unloading Valve, Sequence valve. 1.9. Actuators: single-acting cylinder & double-acting cylinders, rotary actuator. 1.10. Development of simple hydraulic circuits.

	Course Outcome: CO1eaching Hours :12hrsMarks: 14 (R- 2, U-6, A-6)
2	**Pneumatic System Components:** 2.1. Introduction **2.2.** Components of a pneumatic system**.** 2.3. Air compressors:- types, Reciprocating type compressor(construction and working) 2.4. Pressure Regulator cum filter 2.5. Flapper-nozzle system. 2.6. Volume boosters 2.7. Pneumatic relay 2.8. Converters: Pneumatic to Electrical (P to I) and Electrical to Pneumatic Converters (I to P). 2.9. Development of simple pneumatic circuits. **Course Outcome:CO2Teaching Hours :08 Marks:10(R-2 , U-4 , A-4)**
3	**Control Valves** 3.1 Definition, terminology and classification. 3.2 Control valve types: Globe valve, Ball, Butterfly, Solenoid valves(construction, working, valve part materials, ISA symbols, advantages, disadvantages and applications) 3.3 Control valve flow characteristics 3.4 Control valve parameters: Control valve capacity (Cv), valve rangeability, turn-down, valve size and valve gain. 3.5 Control valve problems: Cavitation and flashing. 3.6 Control Valve Actuators: - Spring diaphragm type and piston type pneumatic, electrical actuator. 3.7 Valve positioners: Necessity, types-motion balance and force balance 3.8 Selection criteria of control valves. **Course Outcome: CO3 Teaching Hours :12hrsMarks: 14 (R- 2, U-6, A-6)**
4	**Electrical Control System Components:** 4.1 Switches:Toggle switches, push buttons, DIP switch, rotary switch, thumbwheel switch, limit switches.(No theory question to be asked in exam on switches.) 4.2 Electromechanical devices: Control Relays - Electro-mechanical relay, Reed relay, Solid state relay, Overload relay, Motor starters. 4.3 Circuit breakers: -Need of Circuit Breaker, Operating Principle, and types (Construction, symbolic representation, working, and applications.) 4.4 Special motors: servomotors, stepper motors. (construction,working principle and applications) 4.5 Comparison between pneumatic, hydraulic and electric systems. **Course Outcome:CO4 Teaching Hours :07 Marks:12 (R-2 , U-4 , A-6)**

5	**Auxiliary Components:** 5.1 Alarm annunciator. 5.2 Feeders and dampers. 5.3 Transmitters: 2 wire, 4 wire, DP Transmitter (force balance type). 5.4 Temperature Switch, Pressure Switch. 5.5 Relief Valves, safety valves and rupture disk. (Construction, diagram, symbolic representation, working, applications.) **Course Outcome:CO5 Teaching Hours :06Marks:10 (R-4 , U-4 , A-2)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Hydraulic System Components	2	6	6	14
2	Pneumatic System Components	2	4	4	10
3	Control Valves	2	6	6	14
4	Electrical Control System Components	2	4	6	12
5	Auxiliary Components	4	4	2	10
	Total	**12**	**24**	**24**	**60**

List of experiments: Total 10-12 experiments(or turns) out of 17 experiments(or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	Implementation and testing of Hydraulic circuits for single-acting cylinders.	2
2	2	CO2	Implementation and testing of Pneumatic circuits for single-acting cylinders.	2
3	3	CO3	To draw and identify the parts of cut-view section of single-seated globe valve.	2
4	4	CO4	To test and observe the operation of electro-mechanical relay.	2
5	5	CO5	To find switching time of a temperature switch.	2
6	1	CO1	Implementation and testing of Hydraulic circuits for double acting cylinders.	2
7	2	CO2	Implementation and testing of Pneumatic circuits for double acting cylinders.	2
8	2	CO2	To find the sensitivity of pressure to current converter.	2
9	2	CO2	To find the sensitivity of current to pressure converter.	2
10	3	CO3	To observe the construction of different valves.	2

			(Globe, ball, gate and butterfly valves).	
11	3	CO3	To demonstrate the operation of any two type of control valve actuators.	2
12	3	CO3	To test the performance of electro-pneumatic valve positioner.	2
13	4	CO4	To test and observe the operation of Solid state relay.	2
14	4	CO4	To test the given switch.	2
15	5	CO5	To find the switching time of pressure switch.	2
16	5	CO5	To observe the operation of DP Transmitter.	2
17	5	CO5	To observe the operation of Alarm Annunciator.	2
Total				**30**

Note: Experiments No. 1 to 5 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Hydraulics and Pneumatics: A Technician's and Engineer's Guide	Andrew Parr, Butterworth-Heinemann; 3rd edition,2011	978-0080966748
2	Process control and Instrument technology	C.D.Johnson, Prentice Hall India Learning Private Limited; 8th edition,2006	978-8120330290
3	Process Control	Peter Harriott,Tata McGraw Hill,1edition ,2012	9780070993426
4	Industrial Electronics	Thomas E. Kissell,Prentice Hall Publications,3rd edition, 2012	9780131218642
5	Pneumatics, Festo Didactic	Festo	--
6	Hydraulics, Festo Didactic	Festo	--

E-References:

1. https://nptel.ac.in/courses/112/105/112105047/
2. https://nptel.ac.in/courses/112/103/112103249/
3. https://www.youtube.com/watch?v=MbKrIieogNc
4. https://www.youtube.com/watch?v=FVR7AC8ExIM
5. https://www.youtube.com/watch?v=c-468UPUV2o
6. https://www.youtube.com/watch?v=w5_89hBeRAA
7. https://nptel.ac.in/courses/103/105/103105130/

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	2	3	3	-	1	2	3	1
CO2	1	1	3	3	-	1	2	3	1
CO3	2	2	3	3	-	1	2	2	1
CO4	2	3	3	3	-	1	1	2	1
CO5	1	2	2	2	-	1	1	2	1

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Sagar Panchal	Senior Engineer	VVF Ltd Taloja
2	Mrs. V.K .Pawar	Lecturer in Instrumentation Engg.	Govt. Polytechnic Karad
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4	Mr. K. U. Dawane	Lecturer in Instrumentation Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Instrumentation Engg.

Head of Department
Department of Instrumentation Engg.

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Instrumentation Engineering (Sandwich Pattern)**										
Course Code:**IS19R210**				Course Title: **Electrical Machines**						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2 Hrs 30 min)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	2	-	5	60	20	20	25		25	150

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1&TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment), * Indicates assessment by External Examinerelse internal practical skill test, # indicates Self, on- line learning Mode, @ indicates on line examination. Note: For Minimum passing marks under various heads, refer, examination rule AR 25. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term

Rationale:

This is the subject aim to teach concepts, principle and procedure for operation of electrical machine. Students will be able to analyze the characteristics of DC motor,3-phase and single-phase Induction motor. They also learn applications of 1-phase induction motors and special machine

These machines are used in various fields, industries and many more utilization systems. Learning & the skills obtained will be helpful in satisfying duties such as supervisor, controller and R& D technician.

Course Outcomes: Student should be able to

CO1	Interpret the D.C. Motors
CO2	Interpret the Transformers.
CO3	Interpret the Three phase Induction Motors.
CO4	Interpret the Single phase Induction Motors.
CO5	Select appropriate motor suitable for the particular application.

Course Content Details:

Unit No	Topics / Sub-topics
1	**DC Machines:** **Elements of Electro-mechanical Energy Conversion:** 1.1 Introduction. 1.2 Salient aspects of conversions. 1.3 Energy Balance. 1.4 Magnetic Field system: Energy & Co-energy, Linear System, A simple Electromechanical System. 1.5 Energy in terms of Electrical Parameters, 1.6 Rotary Motion, **Generator Principle:** 1.7 Simple Loop Generator, 1.8 Practical Generator,

	1.9 Types of generators, 1.10 Brush contact drop, 1.11 EMF equation of Generator (Simple Numerical), 1.12 Motor Principle, 1.13 Comparison of Generator and Motor Action, 1.14 Back emf and torque equation of DC motor (Simple Numerical & No derivation), 1.15 Electrical, speed armature current and mechanical characteristics of DC motors series, shunt and compound motors 1.16 Necessity of starter for DC motor, basic concept. 1.17 Reversal of the direction of rotation, 1.18 Speed controls of DC Shunt and series motors. 1.18.1 Armature voltage control method, 1.18.2 field control method, 1.19 Applications of series shunt and compound motors. **Course Outcome: CO1, Teaching Hours: 12 Hrs. Marks: 14 (R- 2, U-8 , A- 4)**
2	**Transformer:** 2.1 Construction and working principle of Transformer. 2.2 Transformer losses. 2.3 Transformer Testing: O.C & S.C test, direct loading test on transformer. 2.4 Efficiency, regulation and rating of transformer. 2.5 Auto Transformer advantages, disadvantages and applications. 2.6 Instrument transformer types and use. 2.7 Three phase transformer – Types of connections and applications **Course Outcome:CO2 Teaching Hours:08 Hrs. Marks: 10 (R- 2, U-4 , A- 4)**
3	**Three Phase Induction Motors:** 3.1 Principle of operation, advantages & disadvantages. 3.2 3ph Squirrel cage induction motor – construction, application 3.3 Slip Ring Induction motor – construction, application 3.4 Synchronous speed, % slip [simple problems] 3.5 Starting of 3 phase induction motor: DOL, Star-Delta, Reduced voltage starter 3.6 Reversal of direction of rotation. 3.7 Starting Torque & Torque – Slip characteristics. 3.8 Speed control: Voltage control, Rotor resistance control &frequency control **Course Outcome:CO3 Teaching Hours:10 Hrs. Marks: 12 (R-2,U-6,A-4)**
4	**Single phase Induction motor and special motors:** Schematic representation, principle of operation and applications of : 4.1 Split phase induction motors. 4.2 Capacitor start induction motor 4.3 Universal motor 4.4 Stepper motor 4.5 Brushless dc motor 4.6 AC Servo motor 4.7 DC Servo motor **Course Outcome: CO4 Teaching Hours:10 Hrs. Marks:14 (R- 2, U-6 A-6)**
5	**Industrial applications of electric motors:** 5.1 Definition of electric drive and advantages 5.2 Classification of electric drive 5.3 Factors governing selection of motor 5.4 Motors for different industrial drives 5.5 Electric Braking: i) Plugging applied to D.C. motor & Induction motor ii) Rheostat

	braking applied to D.C. motor & Induction motor **Course Outcome:CO5 Teaching Hours :05 Hrs. Marks: 10 (R- 4 , U-4 , A- 2)**

Suggested Specifications Table (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**D.C. Machines**	12	2	8	4	14
2	**Transformer**	08	2	4	4	10
3	**Three phase Induction Motor**	10	2	6	4	12
4	**Single phase Induction motor and special motors**	10	2	6	6	14
5	**Industrial applications of electric motors**	05	4	4	2	10
	Total	**45**	**12**	**28**	**20**	**60**

List of experiments: Total 10 experiments (or turns) out of 16 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To draw and study different parts of DC machine	02
2	1	CO1	To study the starter of dc shunt motor and start the motor, reverse the direction of rotation	02
3	2	CO2	To Perform direct load test on transformer and find efficiency and regulation of transformer	02
4	3	CO3	To study the three phase induction motor using DOL, Star - Delta and reduced voltage method.	02
5	4	CO4	To prepare the specification chart of various types of special machines	02
6	5	CO5	To prepare chart for electric braking of motors.	02
7	4	CO2	To study open circuit test & short test of single transformer	02
8	5	CO5	To study the Load characteristics of DC shunt.	02
9	1	CO1	To control the speed of DC motor using armature voltage control method	02
10	1	CO1	To control the speed of DC motor using field control method	02
11	3	CO3	To measure the slip of induction motor by tachometer method and reverse the direction of rotation of three phase induction motor	02
12	5	CO5	To prepare the comparison chart of braking of motors	02
13	3	CO3	To control the speed of induction motor by variable frequency method.	02
		CO4	To prepare charts of Construction/working and application of	

14	4		each type of special motors.	02
15	All units	All CO's	To study single line diagram of Electrical power system to find the fault.	02
16	All units	All CO's	Industrial visit to any Motor winding workshop / Transformer Industry/MSEDCL (Mahadiscom) etc.	--
Total				**30**

Note: Experiments No.1 to 6 are compulsory and should map all units and COs. Remaining 04 experiments are to be performing on the importance of topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year of Publication	ISBN
1	A Textbook of Electrical Technology(Volume II)	B. L. Theraja and A. K. Theraja S. Chand and Co. Ltd.Twenty Third edition	ISBN-10: 8121924375 ISBN-13: 978-8121924375
2	Electric Machines	Ashfaq Husain, Dhanpat Rai & Co.Third edition 2016	ISBN-13**:** 978-8177001662
3	Electrical Machines	S.K. Bhattacharya, McGraw Hill Education; Fourth edition (1 July 2017)	ISBN-10: 9332902852 ISBN-13: 978-9332902855
4	Utilization of Electric Power & Electric Traction	G. C. Garg; S. K. Khanna Publisher, New Delhi, edition	ISBN-10: 8174091645 ISBN-13: 9788174091642

E-References:

- www.nptel.com
- www.electrical4u.com
- www.khanacademy.org
- https://ndl.iitkgp.ac.in/

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2	-	2	2	-	2	3	-
CO2	3	3	-	2	2	-	2	3	-

CO3	3	3	-	2	2	-	2	3	-
CO4	3	3	-	2	2	-	2	3	-
CO5	3	3	-	2	2	-	2	3	-

Industry Consultation Committee:

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Head of Department,
Department of Instrumentation Engg.

I/c, Curriculum Development Cell
Government Polytechnic, Mumbai

Principal,
Government Polytechnic, Mumbai.

Programme : **Diploma in Instrumentation Engineering (Sandwich Pattern)**										
Course Code:IS19R207				Course Title: Digital Techniques						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30Hrs)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	**4**	**--**	**4**	**--**	**--**	**--**	**50***	**--**	**50**	**100**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

This course forms the foundation of computers. This course is introduced with the view that students will become familiar with various digital devices and circuits that are used in microprocessor, microcontroller, computers and other digital systems. It will enable the students to assemble, design, and test logical circuits like multiplexer, demultiplexer, counters, registers etc. This course covers the number systems, logic gates, combinational & sequential logic circuits, analog to digital and digital to analog converters which are important parts of digital systems.

Course Outcomes: Student should be able to

CO1	Familiarize with the number system ,codes and their conversion methods.
CO2	Make use of Boolean expressions to realize logic circuits using different logic gates .
CO3	Realize the different types of combinational circuitsusing logic gates
CO4	Design sequential circuits using flip flop.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Number Systems and codes** 1.1. Number system: Concept of base of number system, Decimal ,Binary ,Octal ,Hexadecimal number system 1.2. Conversion of one number system to another number system (fractional point numbers) 1.3. Binary addition and subtraction 1.4. Binary subtraction using 1's and 2's complement 1.5. Types of codes : BCD code, Excess 3 code, Gray code 1.6. Binary to Gray and Gray to Binary code conversion. 1.7. BCD addition and BCD subtraction using 9's complement **Course Outcome: CO1**

2	**Logic Gates and Boolean algebra:** 2.1 Symbol, truth table, logical expression of Basic Gates (AND, OR, NOT), Derived gates (EX-OR, EX-NOR),Universal gates (NAND, NOR) . 2.2 NAND and NOR gate as a universal gates. 2.3 Characteristics of logic gates: Propagation delay, power dissipation, fan in, fan out, Noise Margin. 2.4 Boolean algebra: Boolean laws, De Morgan's theorems, Simplification and realization of Boolean expression using Boolean laws and De Morgan's theorems. 2.5 Standard Boolean representation: Concept of SOP & POS, Minterm & Maxterm. 2.6 Introduction to K-map : Karnaugh map (K-map) representation of logic function, Simplification of K-map for 2, 3 and 4 variables with don't care condition, Realization of reduced expression using logic gates **Course Outcome: CO2**
3	**Combinational Circuits:** 3.1 Design of Half adder, full adder, Half subtractor and full subtractor using K-map and realization using gates. 3.2 Design binary to gray and gray to binary convertor using K-map and realization using gates. 3.3 4 bit parallel binary adder (IC7483) 3.4 Comparator: 1 bit, 2 bit (design using K-map and realization using logic gates). 3.5 Multiplexer: Necessity of multiplexing, Types (2:1, 4:1, 8:1), multiplexer tree, Application 3.6 Demultiplexer: Necessity of demultiplexing, types (1:2, 1:4, 1:8), demultiplexer tree, Application 3.7 3 to 8 line decoder and 8 to 3 line encoder 3.8 BCD to seven segment decoder / driver(IC 7447) **Course Outcome: CO3**
4	**Sequential circuits** 4.1 Difference between combinational and sequential circuits 4.2 Flip flops: S-R flip-flop using NAND gates, clocked SR flip- flop with preset & clear, clocked J-K flip-flop with preset& clear, Master slave J-K flip-flop, D & T flip flops.(truth table, symbol and operation of all FFs) 4.3 Counters: basic concept of counters, classification (synchronous and asynchronous counter), concept of Up and Down counter. 4.4 Asynchronous counters- Ripple counter and Ring counter circuit and waveforms. Design example of MOD-N counter, 4.5 Synchronous counter- Implementation of 3-bit synchronous counter using k-map with waveforms. 4.6 Shift Registers: Definition, classification, circuit diagram, working and timing diagrams of SISO, SIPO, PISO, PIPO,bidirectional shift register. **Course Outcome:CO4**

Suggested Specifications Table (Theory):

----------NA----------

List of Experiments: Total 18-20 experiments(or turns) out of 27experiments(or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To convert the given numbers of number system into another number system.	2
2	2	CO2	To verify Truth Table of basic gate AND, OR, NOT, NAND, NOR, Ex-OR & Ex-NOR gates using ICS.	2
3	3	CO3	To construct Half Adder and Half subtractor & verify the Truth Table	2
4	4	CO4	To verify truth table of SR FF using ICs.	2
5	2	CO2	Implement simple Boolean equation using logic gates and verify output.	2
6	3	CO3	To construct Full Adder and verify the Truth Table	2
7	4	CO4	To verify truth table of D and T FF using ICs.	2
8	2	CO2	To implement basic logic gates using universal logic gate (NAND).	2
9	3	CO3	To construct Full subtractor & verify the Truth table	2
10	4	CO4	To verify truth table of JK FF using ICs.	2
11	2	CO2	To implement basic logic gates using universal logic gate (NOR).	2
12	2	CO2	Implement and verify truth table of De Morgan's theorem.	2
13	3	CO3	To construct Full subtractor & verify the Truth table	2
14	3	CO3	Design binary to gray convertor using K-map reduction techniques, realize it with using gates and verify the truth table.	2
15	3	CO3	Design gray to binary convertor using K-map reduction techniques, realize it with using gates and verify the truth table.	2
16	3	CO3	To verify truth table of 8:1 multiplexer using IC 74151.	2
17	3	CO3	To verify truth table of 3 line to 8 line decoder using IC.	2
18	4	CO4	Design 1-Bit comparator using k-map reduction technique. Realize it with using gates and verify the truth table.	2
19	4	CO4	To verify the truth table of Comparator (IC7485).	2
20	4	CO4	To construct 3 bit ripple counter using Flip Flop and verify its operation	2
21	4	CO4	To construct and test MOD-6 asynchronous counter using IC 7490.	2
22	2	CO2	Implement and verify truth table of Duality theorem.	2
23	3	CO3	To verify truth table of 4:1 multiplexer using logic gates	2
24	3	CO3	To verify truth table of 1:4 demultiplexer using logic gates	2
25	3	CO3	To design adder and subtractor circuit by using 4 bit parallel binary adder IC (IC7483)	4
26	3	CO3	To implement a circuit to convert BCD to seven segment display using decoder / driver IC. (IC 7447)	4
27	4	CO4	To develop a mini project based on applications of sequential circuits.	4
Total				**60**

Note: Experiments No. 1 to 5and 27 are compulsory and should map all units and Cos. Remaining experiments are to be performed as per importance of the topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Modern Digital Electronics	R. P. Jain Tata McGraw Hill, Education 4th edition (2009)	978-0070669116
2	Principles of Digital Electronics	Donald P. leach , Malvino A. P. and Goutam Saha Tata McGraw Hill, Education 6th edition (2008)	978-0070601758
3	Fundamentals of Digital Circuits	Kumar A. Anand PHI learning private ltd. 4th Revised edition edition (2016)	978-8120352681
4	Digital Electronics	G.K. kharate Oxford; Reprint edition (2010)	978-0198061830

E-References:

1. https://www.tutorialspoint.com/digital_electronics/index.asp
2. https://www.nesoacademy.org/electronics
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
4. www.youtube.com "enter the name of topic"
5. https://drive.google.com/file/d/1tGb-DYogAwGBurLaxzMMWebru_2o8TA6/view
6. https://www.indiabix.com/electronics-circuits/ "select the circuit for simulation "

CO VsPO and CO Vs PSOMapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	1	-	-	-	-	2	1	-
CO2	1	2	2	-	-	-	2	2	-
CO3	-	3	3	-	1	-	3	3	-
CO4	-	3	3	-	1	-	3	3	-

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Sr. No	Name	Designation	Institute/Organisation
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3	Mr. F S Bagwan	Lecturer in Instrumentation Engg.	Govt. Polytechnic Mumbai
4	Mrs. S T Shinde	Lecturer in Instrumentation Engg.	Govt. Polytechnic Mumbai

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I/C, Curriculum Development Cell

Principal

Programme : **Diploma in Instrumentation Engineering**										
Course Code:IS19R 312				Course Title: C and CPP						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2:30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	**4#**	**--**	**4**	**--**	**--**	**--**	**--**	**--**	**--**	**--**

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Course Content Details:

Topics / Sub-topics

1. **First C Program**
   Outline: 1) First C Program -Header Files --example: #include <stdio.h> -main() - Curly braces -printf() -semicolon ; -Compiling a C program --example: gcc filen..
2. **First Cpp Program**
   Outline: First C++ Program -Header files --example: #include <iostream> -main() - Curly braces -cout<< -semicolon ; -Compiling a C++ program --example: g++ filen..
3. **Tokens**
   Outline: 3) Tokens in C and C++ -Data types, constants, identifiers -Keywords --example: if, break, else -Constants -Data types --example: int, float, char, double -F..
4. **Functions**
   Outline: Functions -What is a function -Syntax for declaration of a function - Function with arguments --example: return-type function-name(parameter); - Function without array.
5. **Scope of Variables**
   Outline: Scope of Variables -Introduction -Syntax of declaring a variable --example: data-type var-name; -Syntax for initializing a variable --example: data-type var-name .
6. **If and Else If Statement**
   Outline: Check the conditions in a program -What are Statements. -Syntax for if and -If-else Statement -Errors
7. **Nested If and Switch Statement**
   Outline: Nested if and switch statement -Nested if statement. -Switch statement. - Syntax for nested-if statement -Syntax for switch statement -break statement -Comparision
8. **Increment and Decrement Operators**
   Outline: Increment and Decrement Operators -Increment Operator --example: ++ - Postfix increment --example: a++ -Prefix increment --example: ++a -Decrement Operator ..
9. **Arithmetic Operators**
   Outline: Arithmetic Operators -Arithmetic Operators -Addition Operator --example: a + b -Subtraction Operator --example: a - b -Multiplication Operator --example: a *..
10. **Relational Operators**

Outline: Relational Operators -Double Equal to --example: a == b -Not Equal to -- example: a != b -Greater Than --example: a > b -Less Than --example: a < b -Gr.. 2/2

11. **Logical Operators**
    Outline: Logical Operators -And && -Or || -Not !
12. **Loops**
    Outline: Loops -Loops -Syntax for while and do-while loop -Comparison of while and do-while loop -Syntax for -for loop -Errors
13. **Arrays**
    Outline: Arrays -What are arrays -1-D Arrays -Syntax for Declaration of arrays -- example: data type array_name [size]; -Syntax for Initialization of arrays
14. **Working with 2D Arrays**
    Outline: Working with 2-D Arrays -What are 2-D Arrays. -Range of arrays -Syntax for Declaration of 2-D arrays --example: data type array_name[row][column]; -Syntax for integer.
15. **Strings**
    Outline: Strings -What is a string -Syntax for declaring a string -Syntax for initializing a string -To read a string from keyboard
16. **String Library Functions**
    Outline: String Library Functions What are string library functions. Types of string library functions -Strcpy -Strlen -Strcmp -Strcat
17. **Working with Structures**
    Outline: Working with Structures -Introduction -Syntax of structures -Declaration and initialization -Declaration of structure variable -Accessing structure variables
18. **Understanding Pointers**
    Outline: Understanding Pointers -Introduction -Syntax of Pointer --example: int *iptr; -Declaration --example: int a; (integer a) int *aptr; (pointer to an integer..
19. **Function Call**
    Outline: Function call -types of function calls -function pass by value -function pass by reference
20. **File Handling in C**
    Outline: Files in C -File handling functions -Opening a File closing a file --example: fopen, fclose -Reading data from a File.

Coordinator,
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Department of Instrumentation Engg.

I/C, Curriculum Development Cell

Principal

Programme : **Diploma in ME/CE/EE/CO/IF/IS/EC/RT/LT/LG (Sandwich Pattern), AIML**										
Course Code: UV19R103				Course Title: Universal Human Values-III						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total (Credit)	TH (2 Hrs 30min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	--	-	**02**	-	-	-	--	--	--	--

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal practical skill test, # indicates Self, on- line learning Mode, @ indicates online examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26.Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

This course aims to cultivate essential human values and ethics in students to become responsible citizens. It fosters understanding of virtues advocated by great Indian philosophers like truth, non-violence, morality and social responsibility. Students apprehend philosophies of thinkers like Mahatma Gandhi, Swami Vivekananda and Bharat Ratna Dr.Babasaheb Ambedkar; develop courage,patience and dignity through experiences of loyalty and duty; and practice yoga for well-being.

Adopting discussions, debates, visits, reports and applications, the course transforms students into strong, sensitive and virtuous members of society with high moral character and social conscience. In essence, it promotes human values, inculcates ethics and develops the best citizens of India.

Course Outcomes: On completion of this course, student should be able to

CO1	Express gratitude through compassionate service and unconditional giving.
CO2	Spread hope, optimism and cheer through positive words and deeds.
CO3	Understand responsibilities towards the planet, fellow beings and future generations.
CO4	Internalize lessons from great souls who exemplified nobility, courage and righteousness.
CO5	Appreciate life as sacred and valuable; and pursue meaning, purpose and peace.
CO6	Develop holistic well-being through balancing individual needs with common good.

Course Content Details:

Sr. No	Activity	Related Value/s	Methodology of Implementation	Student's Role	Mentor's role	Resources Required
01	Read and create abstract of biography like, 1. ek hota carver 2.Biography of a yogi 3. JRD Tata 4. Mahatma Gandhi 5. Pant pratinidhi 6. Shriman Yogi	Righteousness	Visit library, find out books, read and prepare the report	Students will need to select a biography to read and create an abstract that summarizes the key ideas and messages in the biography.	Mentors will need to provide guidance and support to help students select an appropriate biography and create a well-written abstract.	Access to a library or online resources to select a biography to read and create an abstract.
02	NDRF one day training OR Police Mitra training OR Red cross training OR Fire safety training OR Self defense training for Girls OR CPR training	Accountability Empathy	Plan training with the help of related agencies	Students will need to attend a one-day training session.	Mentors will need to provide guidance on attending the selected training session and ensuring safety.	Access to training facilities and materials may be necessary.
03	Debate on a particular topic among group of students	Clarity of thoughts Politeness	Prepare small groups of students, Choose topics. Avoid controversial topics	Students will need to participate in a debate on a given topic and follow the rules for participation.	Mentors will need to provide guidance on debate topics and rules for participation and provide feedback on students' performance.	A list of debate topics and rules for participation may be required.

04	List different incidents witnessed by you related to loyalty and write a report on it	Loyalty	List related incidents, discuss with mentor and write report.	Students will need to observe and report on incidents related to loyalty and submit a report summarizing their findings.	Mentors will need to provide guidelines on what should be included in the report and provide feedback on students' observations.	A template for the report or guidelines on what should be included may be helpful.
05	Analyse behaviour pattern of self and group member while performing any group activity	Harmony in behavior	List different group activities, select anyone from the list and perform it.	Students will need to analyze their own behavior and that of their group members during a group activity and record their observations.	Mentors will need to provide guidance on observing and recording behavior patterns and provide feedback on students' observations.	Guidelines for observing and recording behavior patterns may be necessary.
06	Visit tribal area and spread awareness about sanitary practices,hygiene and education	Empathy Social Gratitude Selflessness	List nearby tribal areas and prepare detailed plans.	Students will need to plan and conduct an awareness campaign in a tribal area to educate the local community on a selected topic.	Mentors will need to provide guidance on planning and conducting an awareness campaign and provide feedback on students' materials and presentations.	Materials for creating educational materials or presentations may be needed.

07	Visit websites of reputed industries and study their Corporate Social Responsibility (CSR) activities. Also arrange an interview of a successful entrepreneur.	Social Gratitude Accountability	Visit CSR section of the website of selected industry	Students will need to research and report on the CSR activities of a selected industry.	Mentors will need to provide guidance on researching and reporting on CSR activities and provide feedback on students' reports.	Access to the internet or relevant industry publications may be required.
08	1.Seven blunders told by Mahatma Gandhi and practice them as an ethic in your daily life to be a moral citizen. 2. Swami Vivekananda and his philosophy 3.Bharatratna Dr Babasaheb Ambedkar and his philosophy, teachings Any other social reformer	Character Humanity Sacrifice Honesty Accountability Patriotism	Select anyone topic. Prepare Group presentations on selected topic.	Students will need to prepare and present a group presentation on a selected topic.	Mentors will need to provide guidance on preparing and presenting a group presentation and provide feedback on students' presentations.	
09	Understanding Eight limbs (Ashtanga) of Yoga for gaining the best mental health.	Health consciousness Social gratitude	Arrange the session of a meditation expert to understand the philosophy of Yoga.	Students will need to understand and practice the principles of the eight limbs of yoga. Practice it daily for the best physical and mental health.	Mentors will need to provide guidance on understanding and practicing the principles of the eight limbs of yoga and provide feedback on students' progress.	Resources such as yoga mats or printed materials on the eight limbs of yoga may be required.

10	Eight-fold ashtangik path for cessation of sufferings OR Vipassana	Truthfulness Non-violence Contentment Persistence	To understand the philosophy and its use to stop suffering	After understanding share the experiences with others. Apply it in your daily life.	Provide related resources	https://en.wikipedia.org/wiki/Ashtanga_(eight_limbs_of_yoga)
11	Writing daily diary	Honesty Punctuality	Student to write diary every day	Students will need to write a daily diary entry reflecting on their thoughts, feelings, and experiences.	Mentors will need to check and provide feedback on daily diary entries to encourage reflection and self-awareness.	Each student will need a notebook or journal.

Methodology:

1. The course is Non Examination, Credit Course.
2. The course will be introduced during the student induction programme (orientation programme) of one week duration. Most of the activities are to be completed during induction programme and to be continued throughout the term during SCA hours under the guidance of mentor.
3. The mentor will be assigned to the student for a group of 20 students each.
4. In consultation and under supervision of a mentor, the student/ Group of students has to complete the activity.
5. Activities no. 6,7, 9 and 10 can be performed in collaboration with related government organizations or industries (under CSR activity).
6. All events will be organized and managed by students. The mentor will work as a facilitator/ advisor.
7. The strategies to learn the course is "Self- Exploratory" and "Experiential Learning"
8. The onus of responsibility for completing the activities is with students.
9. The student has to complete at least **five** no. of activities throughout the term to earn the credits.
10. Activity no.6 is compulsory.
11. Students will write reports on each activity performed and submit it to mentors to earn credits.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	978-8-174-467 81-2
2	Human Values	A.N. Tripathy, New Age International Publishers, 2003	978-8-122-425 89-5
3	Teacher's Manual - A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	-
4	Science and Humanism, Towards a Unified World View	PL Dhar, RR Gaur, Commonwealth Publications, 1992	978-8-171-692 22-4
5	Education for values in schools- a framework	NCERT	
6	Value oriented education	E N Gawande	
7	Autobiography of a Yogi	Paramahansa Yogananda, Yogoda Satsanga Society of India; Complete edition (9 February 1998)	978-818953551 3
8	Teachings of Swami Vivekananda	Swami Vivekanada, Vedanta Pr; Fifth edition (1 June 1971)	978-818530187 7

E-References:

1) **https://youtu.be/kOJu1vj_BVk (The 10 Most Important Human Values)**
2) **https://youtu.be/QeogOlzG2ls (Value of Education -short film)**

E-References for mentors:

1) **https://www.edutopia.org/**
2) **https://en.wikipedia.org/wiki/Seven_Social_Sins**

Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr. L.A. Patil	Principal (Retired)	Pratap College, Amalner
2	Dr. Nitin Deshpande	Lead Consultant	Dnyanpeeth Academy, Pune
3	Dr. Chandrakant Shahasane	Founder Trustee	Karnala Charitable Trust, Pune
4	Mr. U.A. Agnihotri	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai
5	Mr. K. V. Patil	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai

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