

1	Name of Course	CERTIFICATE COURSE IN AUTOMATION & PLC (W.E.F. 2017-2018)																																									
2	Couse code	301135																																									
3	Max No of Students Per Batch	25																																									
4	Duration	6 Months																																									
5	Type	Part Time																																									
6	No of Days/Week	6 Days																																									
7	No of Hours Per Day	4 Hours																																									
8	Required Space	Class Room – 200 sq.ft, <u>Laboratory – 200 sq.ft</u> Total – 400 sq.ft																																									
9	Minimum Entry Qualification for Student	SSC + 1 Year Relevant Experience / ITI (Electric/Electronic/ Instrumentation) / IMCP / MM TM Or HSC (Voc) in Electrical/Electronic Group) / Diploma / Degree in any branch.																																									
10	Objective of Course	To Create man power in Automation & PLC filed																																									
11	Employment Opportunity	Process control industry / Pharmaceutical / Food & Beverage industry.																																									
12	Teacher’s Qualification	Diploma / Degree in any branch + 1 Year Experience Relevant field.																																									
13	Training System	Training System Per Week <table><tr><td>Theory</td><td>Practical</td><td>Total</td></tr><tr><td>06 Hrs</td><td>18 Hrs</td><td>24 Hrs</td></tr></table>							Theory	Practical	Total	06 Hrs	18 Hrs	24 Hrs																													
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14	Exam. System	<table><tr><th>Sr. No.</th><th>Paper Code</th><th>Name of subject</th><th>Th /PR</th><th>Hours</th><th>Max. Marks.</th><th>Mini. Marks</th></tr><tr><td>1</td><td>30113511</td><td>Automation & PLC</td><td>TH-I</td><td>3 hrs.</td><td>100</td><td>40</td></tr><tr><td>2</td><td>30113521</td><td>Practical of Automation & PLC</td><td>PR-I</td><td>6 hrs.</td><td>200</td><td>100</td></tr><tr><td>3</td><td>30113522</td><td>Project</td><td>--</td><td>--</td><td>100</td><td>50</td></tr><tr><td></td><td></td><td>Total</td><td></td><td></td><td>400</td><td>220</td></tr></table>	Sr. No.	Paper Code	Name of subject	Th /PR	Hours	Max. Marks.	Mini. Marks	1	30113511	Automation & PLC	TH-I	3 hrs.	100	40	2	30113521	Practical of Automation & PLC	PR-I	6 hrs.	200	100	3	30113522	Project	--	--	100	50			Total			400	220						
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CERTIFICATE COURSE IN AUTOMATION & PLC

Theory – I & Practical - I - AUTOMATION & PLC

WE EK NO.	PRACTICAL - I Practical of Automation & PLC	THEORY - I Automation & PLC
1	<ul style="list-style-type: none">• Demonstration of care and safe working habits, first aid, treatment of electrical sock• Lab demo of tools and measuring & test instruments related to the trade	<p>Safety precaution to be observed in the trade during training hours. Electrical safety. Elementary first aid.</p> <p>Earthing –types and importance. ISI rule on earthing. Fuses and its type. Use of personal protective equipment from electrical safety point of view.</p> <p>Identification, specification, uses and maintenance of hand tools and measuring & test instruments</p> <p>Revision of electrical fundamentals, Ohm's law, semiconductor theory, diode and transistor characteristics.</p>
2	<ul style="list-style-type: none">• Verification of network theorem• Study of RLC circuits• Determination of Q factor of a coil	<p>Circuit theory : Kirchhoff's law, superposition theorem. Thevenin & Norton's theory. Star Delta transformation, maximum power transfer theorem (detailed mathematical treatment not required)</p> <p>Series & Parallel AC circuits, AC through R.L.C., RC, RL, RLC network, resonance, Q factor of a coil.</p>
3	Demonstration of conventional methods of DC motor speed control	<p>DC motors- principle, types and characteristics.</p> <p>Speed control methods of DC motors – Armature voltage control and Field voltage control. Motor starter circuits.</p> <p>AC Motors – Principle of operation of 1 phase & 3 phase AC induction motors using starters. Reversing of motors.</p> <p>Synchronous Motors – characteristics and their applications.</p> <p>Electrical Breaking and its types mechanical brakings, Plugging, Rheostatic breaking, Regenerative braking etc.</p>
4	Demonstration of conventional methods of AC motor speed control	<p>Synchronous Motor and their applications.</p> <p>Electrical Braking and its types – Mechanical braking, Plugging, Rheostatic bracking, Regenerative braking etc.</p>

5	Demonstration of Physical systems – mechanical, fluid and thermal.	<p>Introduction to control system, basic concept of control, Open loop and close loop control system with examples, concept of linear and non-linear system.</p> <p>Definition of a physical system – mechanical, electrical, fluid and thermal system with examples (i.e. dash-pot, electrical motor, tank level and flow control, water heating system etc.)</p> <p>Elementary idea of transfer function, transfer function of above systems. Block diagram representation of above systems.</p>
6	Demonstration of control system components like servo motors, encoders, tacho-generators, stepper motors and synchros, flapper nozzle system	<p>Control system components – Feedback control system and controllers.</p> <p>Principle of working, transfer function and application of following components: D.C. servo motor, A.C. servo motor, D.C. and A.C. Tacho-generators, synchros, stepper motor, rotary encoders, servo mechanism, flapper nozzle system. (Detail mathematical treatment not required.)</p>
7	<p>Use of signal and function generators : Observation of output waveform of response of simple electrical system after applying test signals.</p> <p>Study of flapper nozzle system.</p>	<p>Time domain analysis of a system : Standard test signals used, concept of impulse response, response of first and second order system to step input (steady state and transient response), steady state error and error, concepts of stability.</p> <p>Concepts of process characteristics – lag, time delay, dead zone etc.</p>
8	<ul style="list-style-type: none"> • Demonstration of modulations and demodulation on training kits. • Demonstration of pulse modulation 	<p>Introduction to communication system and its importance.</p> <p>Analog communication : Fundamentals, modulation and demodulation techniques, basic concepts of AM, FM and PM and its applications.</p> <p>Electromagnetic waves, frequency ranges, speed of transmission, band-width, antenna.</p> <p>Digital communication : principles of digital communication, different types of pulse modulations: PCM, FSK, PSK, ASK etc. multiplexing.</p> <p>Simple concepts of communication (block diagram only) : Telephone (fixed and mobile), radio, microwave and LASER, DA and PA system.</p>

9	<ul style="list-style-type: none"> • Demo of fibre optic system. • Demonstration of serial & parallel communication techniques. 	<p>Fibre optical communication – principles, methods and application.</p> <p>Satellite communication – methods and applications.</p> <p>Data communication : Simplex and duplex modes, serial & parallel communication, modems Serial communication standards : RS – 232, RS – 422, RS – 485 standards.</p> <p>Networking principles and topology, Local area network standards</p>
10	<ul style="list-style-type: none"> • Observation of different types of power, electronic components • Thyristor characteristics. • Firing of thyristor : resistance, RC, UJT & logic gates • Commutation of thyristor : natural, line and forced. • Checking of power MOSFET, thyristors, IGBT, GTO, IGCT 	<p>Power electronics : Introduction to power electronic devices: Thyristor, its construction characteristics and family (DIAC, TRIAC, SBS, SUS)</p> <p>Turn “ON” & turn “OFF” behavior of thyristor.</p> <p>Firing & commutation circuits, role of snubber circuit.</p> <p>Rating & protection of thyristor.</p> <p>Power diodes and power BJT, power MOSFET, IGBT, GTO, IGCT and their application</p>
11	Study of converter : half wave, full wave,. Half wave controlled. Chopper, Inverter.	<p>Thyristor circuits:</p> <ol style="list-style-type: none"> a) Converter b) Regulator (AC) c) Chopper d) Inverter e) IGBT circuit, its use in converter, inverter and UPS
12	<ul style="list-style-type: none"> • Understanding parameters of DC drives • Checking of firing pulses in a digital drive 	<p>Electric Drive : Classification of load and motor according to their speed/torque characteristics and drive performance characteristics. Behavior of drive system during change of state.</p> <p>Modern drive system : concept of open & closed loop system DC drive : single & four quadrant control.</p>
13	<ul style="list-style-type: none"> • Understanding parameters of AC drives • Checking of firing pulses in a digital drive • Understanding of UPS working 	<p>AC drive : stator V/f, rotor resistance & voltage.</p> <p>Basic concepts of digital drives.</p> <p>Understanding of float charger, off-line UPS and On-line redundant UPS, circuit and maintenance of UPS.</p>

14	<ul style="list-style-type: none"> Identify simple components such as reservoir, filter pumps, valves, actuators etc. Operation of proportional and servo valves, functions of control and feedback components 	<p>Fluid power:</p> <p>Basic principles of hydraulic and pneumatics, characteristic of fluid media</p> <p>Operational details of fluid power control element. (Constructional details not required)</p> <p>Energy converter, Fluid conditioner, Control valves</p> <p>Symbols of basic hydraulic and pneumatic components.</p> <p>Basics of proportional and servo valves, its electrical and electronic circuitry, control and feedback systems</p>
15	<ul style="list-style-type: none"> Simulation of simple hydraulic circuits. Simulation of simple pneumatic circuits 	<p>Concepts of interfacing of hydraulic & pneumatic components with controllers</p> <p>Hydraulic and pneumatic circuits, reading and interpretation.</p> <p>Specifications of components and safety aspects.</p>
16	<p>Process Control</p> <ul style="list-style-type: none"> Operation of a controller, setting of its PID values, controller tuning. Fault finding and trouble shooting exercises on simulators. 	<p>Process control automation</p> <p>Introduction to process control, process variables, manual & automatic control system close loop & open loop process control systems, process disturbances, process dynamics. P.D & I control modes. Tuning of a controller.</p>
17	Overhauling and calibration of control valves, valve positioners and I/P converters.	<p>Final control elements: I/P converters: types, working principle, construction, calibration and maintenance. Control valves & actuators: types, working principle, construction, characteristic, calibration and maintenance. Selection and sizing of a control valve. Valve positioner : types, working principle, construction, calibration and maintenance.</p>
18	<ul style="list-style-type: none"> Familiarization with different I/O modules of PLC. Development of simple programmes involving bit level instructions, timers and counters, simple Data manipulation instructions. 	<p>Introduction to PLC its hard ware details. Function and working of different cards.</p> <p>Program techniques of PLC, inputs, outputs, timer and counter instructions, data manipulation.</p> <p>Development of simple programs.</p> <p>Documentation, different functional blocks & mathematical instructions.</p>
19	<ul style="list-style-type: none"> Feeding and running the programmes in PLC, I/O forcing. Documentation and editing of programmes. Simple fault finding and trouble shooting. 	<p>DCS : basic concepts, advantages, Architecture of typical DCS, function of different nodes and modules, Programming concepts, applications.</p> <p>Industrial weighing system components and applications. Static and dynamic weighing systems.</p>

20-21	<ul style="list-style-type: none"> Demonstration of SCADA system, communication system used in networking of PLC. 	<p>DAS and SCADA, Introduction to MMI packages, applications, Reading and interpretation of PI diagrams, instrument manuals and part list, panel wiring diagram etc.</p> <p>Instrument cabling, relays, terminals, fuse terminals, junction boxes, MCBs, cable gland, pipe and its colour code, air filter regulators.</p> <p>Basic concepts of FIELDBUS, its types and applications area.</p> <p>Earthing and grounding of instruments and its importance.</p>
22-23	Reading & interpretation of P & I diagrams.	<p>Industrial control application: Cement plant- Process overview, major units, automation strategies, mill automation, kiln automation, dispatch automation, levels of automation, case studies of automation used in major cement plants.</p> <p>Thermal power plants- process overview, major units and process variable, automation strategies, boiler control and automation, turbine control and automation, fuel and its control, levels of automation, case studies.</p>
24	Exercise on instrument fault finding and trouble shooting.	<p>Steel plants- Different zones – iron, steel and mills, process overview of different zones and its control, case studies.</p> <p>Process and automation system used in industries located near the institute may also be covered.</p>
25-26	Revision & Exam	Project, Revision & Examination
27	One Project should be done as above syllabus.	

List of Tools & Equipment

Sr. No.	Description of Item	Qty
1	Connecting screwdriver 100 mm	8
2	Neon tester 500 V.	8
3	Screw driver set (set of 5 bits)	8
4	Insulated combination pliers 150 mm	8
5	Long nose pliers 150 mm	8
6	Soldering iron 25 W, 240 V	8

7	Electrician knife D.B.	8
8	Insulated side cutting pliers 150 mm	8
9	Digital multimeter	2
10	Function generator	1
11	Signal generator	1
12	First aid kit	1
13	30-0-30 V, 2 Amps DC regulated power supply	2
14	0-300 V, 500 mA, DC regulated power supply	2
15	LCR Bridge (Digital)	1
16	Digital storage Oscilloscope, 100 MHz, with probe	2
17	Analog communication training kits	2
18	Digital communication training kits	2
19	Fibre optics training kits	2
20	Serial communication training kits	2
21	LAN trainers	2
22	Power electronic training kit	2
23	IGBT trainers	1
24	Proportional Hydraulic trainer	1
25	Servo Hydraulic trainer	1
26	Synchros	1
27	Personal computer with latest configuration with printer	4
28	Pneumatic trainer	1
29	PID controller training kits	1
30	PLC training kits with industrial PLC, programming terminals	2
31	SCADA trainer	2
32	Process control trainer (Feedback make)	2
33	Sensor Trainer	2
