Dated: 11th April, 2012

To,

Sub: Response to Instrumentation engineering diploma programme questionnaire.

Dear friend,

Gujarat Technological University is re-designing the curricula of its diploma engineering programmes to match with the needs of the industries. For this purpose, we have collaborated with National Institute of Technical Teachers' Training and Research Bhopal (NITTTR Bhopal) who have the expertise in developing the curricula for technical educational programmes at national level.

It has been decided by NITTTR Bhopal and GTU to design the curricula on the outcome/competency-based approach so that passouts are not only theoretically knowledgeable, but are also able to perform well in the industry at the time of joining the industry from the polytechnic system. Once this curriculum is developed it would guide efforts of teachers and students to achieve the identified competencies.

For development of such a scientific curriculum, identification of the competencies to meet the requirements of the industry is the first step.

For the project, this questionnaire is jointly developed by GTU and NITTTR, which is designed to identify the entry-level competencies expected of Instrumentation engineering diploma holders required to perform their jobs independently in an industry to avoid the present long-term training given to freshly recruited engineering diploma holders.

We would be thankful if the person, who is actually taking work from the Instrumentation Engineering Diploma pass outs, responds to this questionnaire. Your response is voluntary and would be used only for academic purposes and would not be shared with any other agency. Only the collated responses of all the industries would be used for decision making.

Thank you very much for your valuable responses.

Yours sincerely,

Dr. Akshai Aggarwal

Curriculum Development Project

Identification of Competencies Required of

Instrumentation Engineering Diploma Holders

Terms of Reference for this Project

'Competency' is what you expect a fresh engineering diploma holder to do at the entry level, i.e. *'a statement which describes the integrated demonstration of a cluster of related skills and attitudes that are observable and measurable necessary to perform a **job** independently at the workplace, at a prescribed proficiency level'.*

While a *'**job'*** is that which you will call upon your engineering diploma holder to do i.e. *'a complete activity having a definite beginning point and an ending point, which can be performed over a short period of time independent of other works resulting in a product, service or decision'.*

The ***'prescribed proficiency level'*** is the *'threshold level'* at the end of three years of study at the polytechnic.

With these *terms of reference* in the background, your opinion of the competencies concerning a ***fresh*** engineering diploma passouts are listed here. Against each, you are required to ***state your opinion*** by ticking **(√)** in the most appropriate box in the enclosed ***one sheet*** questionnaire.

Name of the Industry……

Main Product……
Address of the industry ……
……
……

Approximate number of engineering diploma holders employed in your industry:

a) Electrical Engineering Diploma Holders ……..Nos.
b) Mechanical Engineering Diploma Holders ……..Nos.
c) Electronics Engineering Diploma Holders ……..Nos.
d) Instrumentation Engineering Diploma Holders ……..Nos.
e) Civil Engineering Diploma Holders ……..Nos.
f) Chemical Engineering Diploma Holders ……..Nos.
g) Computer/IT Engineering Diploma Holders ……..Nos.

Table – 1

Preferably this questionnaire needs to be filled up by ***those who take work*** from ***instrumentation engineering diploma holders***

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
T1	Use transducers used in measurement of process parameters like RTD, Thermocouple, strain guage, capacitive type, LVDT, photovoltaic cell, Optical & radiation Pyrometer, Infrared transducers, Electronic valve positioners, E/P, I/P, P/I, P/E converters (Transmitters), digital encoders (Incremental & absolute) , selsyn, synchros, quartz, presence & occupation sensor, contact & non-contact types speed pickups (Proximity transducers), Gyroscopes, SMART instruments & transmitters etc.				
T2	Maintain(Repair & overhauling) telemetry systems (pneumatic/ electric/ electronic/ hydraulic(filled system), servo system, Communication modes -Field bus, Mod bus, Profi bus & wireless as transmission/ communication used in process industries.				

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
T3	Use filled system indicators, recorders, transmitters for temperature, pressure, flow, level etc.				
T4	Test low power electronic devices like diode,rectifiers, power supplies, SMPS,UPS,Transistors, High frequency switching transistors, Transistor amplifiers.				
T5	Test high power control electronic components like thyristors viz. SCR/DIAC/TRIAC/SUS/SCS, power MOSFETS,GTOs, IGBTs, IGCTs.				
T6	Test digital integrated components like Logic gates viz. AND/OR/NAND/NOR/EX-OR/EX-NOR, combinational logic circuits, Flip flops, Counters & Registers, multiplexers & demultiplexers, multivibrators, memory viz. RAM/ROM/PROM,EPROM,EEPROM ADC & DAC, Programmable logic arrays .				
T7	Know stability of control systems using time response analysis viz. root locus/ routh Hurwitz criteria, frequency response analysis viz. bode plot/polar plot/ nyquist criteria for any one control application .				
T8	Draw various process documents viz. ISA symbols, process flow/piping & Instruments/hook up/Instrument location diagrams used in industrial processes viz. cement, food & beverages, textile, chemical(petro-fertiliser-agro-pharmaceutical), aviation, nuclear, automobile, conventional/nonconventional power plants				
T9	Maintain(Repair & overhauling) various schemes viz. automatic stop motions & furnace temperature control, single, double & 3 element boiler control, cascade, ratio, feed forward, split range for simple process instrumentation systems.				
T10	Know bugs of program written using 8085 microprocessor interfaced with peripheral chip viz. 0808, 0809, 8155, 8251, 8255, 8257, 8259.				
T11	Maintain(Repair & overhauling) industrial instrumentation (Indicators, recorders(Digital), portable recorders, controllers, transmitters) used in process plant for measurement of process parameters like temperature, pressure, flow, level, humidity, moisture, Weight (Load cell), Speed (proxy, techo, Optical) ,Vibration (proximity type transducers) etc .				

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
T12	Calibrate industrial instrumentation (Indicators, recorders(Digital), portable recorders, controllers, transmitters) used in process plant for process parameters like temperature, pressure, flow, level, humidity, moisture, speed etc .				
T13	Maintain(Repair & overhauling) final control elements like valve actuators, Positioners- Electronic valve Positioners & SMART, potentiometers, resolvers/ Feedback limit switches , Filter regulator, control valves (solenoid valve, VFD (Variable frequency device valve) used in industrial instrumentation (Mechanical/electrical) control systems.				
T14	Test electronic instruments like SSG,VOM,DVM,CRO,Indicators, loop power indicators, cabling & earthing fault detector, recorders, chartless recorers, Data loggers, PID/ PI/PD controllers, P-I/P-E converters, conventional & SMART transmitters, proximity switch, all types of process parameter limit switches, CT/PT transformers, display devices viz. alphaneumeric, LCD,LED, multi colour LEDs, Touch screen.				
T15	Test pneumatic instruments like I-P, E-P,R-P pneumatic PID controllers, differential pressure devices, pressure switches, SLPC (Single loop process Controller),Lop power supply, Dedicated power supply.				
T16	Maintain(Repair & overhauling) control instrumentation viz. Indicators, recorders, PID/ PI/PD controllers, P-I/P-E converters, conventional & SMART transmitters, proximity switch for process parameters like temperature, pressure, flow, humidity, speed, moisture, conductivity, level etc.				
T17	Test various analytical instruments like PH/Radox,ORP, thermal/electrical Conductivity, density, radiant energy, spectro photo meters, ultrasonic flaw detectors, TOFD (Time of flight deflection for flaw detection), refractometers, Gas chromatograph, polarography, Gas analyzers (O_2, CO,CO_2, NO_x ,TOC), Twist tester, Strength tester, Fibroscope, Tensile tester, colour matching & weighing balance etc.				

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
T18	Calibrate various analytical instruments like PH/Radox,ORP, thermal/electrical Conductivity, density, radiant energy, spectro photo meters, ultrasonic flaw detectors, TOFD (Time of flight deflection for flaw detection), refractometers, Gas chromatograph, polarography, Gas analyzers (O_2, CO,CO_2, NO_x ,TOC), Twist tester, Strength tester, Fibroscope, Tensile tester, colour matching & weighing balance etc.				
T19	Apply various analytical instruments like PH/Radox,ORP, thermal/electrical Conductivity, density, radiant energy, spectro photo meters, ultrasonic flaw detectors, TOFD (Time of flight deflection for flaw detection), refractometers, Gas chromatograph, polarography, Gas analyzers (O_2, CO,CO_2, NO_x ,TOC), Twist tester, Strength tester, Fibroscope, Tensile tester, colour matching & weighing balance etc.				
T20	Build industry specific process instrumentation circuits as projects.				
T21	Prepare reports of the technical project using MS-office package(word, excel, power point) which includes information derived from internet/ email of registration (PAN/TAN/SSI), regulatory (Polution/ zonal/ human resources(Labour)/ financial resources(PF), taxing & costing purposes(ST/VAT/Excise/Incomtax/professional Tax etc.), Tender documents : downloading, comparative statements preparation.				
T22	Maintain(Repair & overhauling) instrumentation records/drawings/ indexing/ library references /accounting & inventory management system by ERP/SAP.				
T23	Maintain(Repair & overhauling) process related instruments used in treatment plant in refinery, chemical(petro-fertiliser-agriculture-pharmaceutical) plants, utility viz. water treatment, instrument air, disaster management, SIS (safety Instrumentation system), SIL (Safety instrumentation symbol, level, : 1-4) , safety area classification, instrument safety, fire safety, hazardous operation (Hazop : A-1 to A-4) , calibrating certification of primary calibrator for various process parameters & explosive limits etc.				

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
T24	Install ,commission & check out process instruments like Indicators, recorders, PID/ PI/PD controllers, Final control elements, P-I/P-E converters, conventional & SMART transmitters, proximity switch for process parameters like temperature, pressure, flow, humidity, speed, moisture, conductivity, level etc., PLC, DCS, SCADA				
T25	Select methods for instruments like Indicators, recorders, PID/ PI/PD controllers, P-I/P-E converters, conventional & SMART transmitters, proximity switch, factors affecting the respective measurements of process parameters like temperature, pressure, flow, level etc.				
T26	Diagnose AC and DC motor Speed Control Systems- VFD (variable frequency drives) employing speed & torque principles using converters, cycloconverters, choppers, inverters etc.				
T27	Maintain(Repair & overhauling) electronically controlled sequential operation for any process related application viz. dryer, nitrogen plant, bagging system, resistance welding.				
T28	Maintain(Repair & overhauling) biomedical instruments like ECG, EEG, EMG, Sonography & Xray imaging machines, Therapeutic/ medical laboratory/ surgical instruments etc.				
T29	Follow/Observe patient safety measures & practices employed in biomedical measurements.				
T30	Know Bugs from programs written using 8051 mictrocontroller.				
T31	Develop various programs by FBD & Ladder diagram of programmable devices, such as logic controller for industrial process control & automation applications viz. continuous/discrete/composite process control				
T32	Understand SCADA & distributed control system using instrumentation hardware /software tool kit for process industries such as cement/chemical (petro-fertiliser-agriculture-pharmaceutical)/ refinery/food & beverages/ textile/power generation & distribution/automobile plants.				

	TECHNICAL COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
	Any other additional competencies				
T33	Use softwares like electronic work bench, process simulators etc. for simple applications.				
T34	Understand Instrumentation in large and small wind turbines, solar photo voltaic (PV), Biogas, tidal power, solar heating systems.				
T35	Maintain(Repair & overhauling) Instrumentation in				
T36	Maintain(Repair & overhauling) Instrumentation in systems.				
T37	Maintain(Repair & overhauling) Instrumentation in systems.				
T38	Maintain(Repair & overhauling) Instrumentation in systems.				
T39	Follow safety identifying disasters / calamity, fire, electrical, chemical accidents followed in process industry				
T40	Use Wireless Instrumentation systems employed in process industry.				
	Any other additional Technical Competencies				
T41					
T42					
T43					
T44					
T45					
T46					
T47					

Table – 2

Some generic ***competencies*** required by a diploma holder from any branch of engineering are also listed below. Kindly rate them by placing a tick in the appropriate column.

	GENERIC COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
G1	Communicate effectively in English in oral and written form with superiors, subordinates and peers.				
G2	Communicate effectively in Gujarati in oral and written form with superiors, subordinates and peers				
G3	Manage people at work				
G4	Think creatively and apply innovative skills in problem solving				
G5	Work as a group leader & as a team member to achieve goals				
G6	Lead group discussions and meetings independently				
G7	Use all resources like media, market survey, technical literature etc. to gather information for taking decisions				
G8	Select different electrical circuit components like resistors, capacitors, inductors, transformers, Relays- SSR/REED, Diodes, transistors, batteries, indicators viz. LED/LCDs, displays, OPAMPS, linear ICs, Digital ICS, Programmable devices, alarm devices, Thyristors, UJT, microphones.				
G9	Develop program using “C” language.				
G10	Develop enterprising skills required for an entrepreneur.				
G11	Assemble & Build simple circuit using different electronic circuit components on Printed Circuit Board.				
G12	Test simple circuit using different electronic test & measuring instruments.				

	GENERIC COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
G13	Work with Internet				
G14	Assemble, Install and trouble shoot computer hardware, peripherals, office equipments, Public address, CCTV systems .				
G15	Install & configure Network Operating system & associated application softwares in context to DCS.				
G16	Follow Safety consciousness and safe working practices.				
G17	Take Care of equipment and tools.				
G18	Develop Punctuality, discipline and honesty.				
G19	Concern for quality.				
G20	Respect for rules and regulations.				
G21	Concern for health and hygiene.				
G22	Build Cordial relationship and Cooperation with co-workers and team Work.				
G23	Develop Positive attitude and behavior.				
G24	Attain Responsibility and accountability.				
G25	Learn continuously.				
G26	Acquire Communication Skills.				
G27	Concern for environment and waste disposal.				
G28	Develop Ability for planning, organizing and coordinating.				
G29	Develop Creative thinking, problem solving and decision making skills.				
G30	Develop Leadership.				

	GENERIC COMPETENCIES ▪ ***Essential*** means it is core competency and used frequently ▪ ***Not applicable*** means not required in your industry at all.	*Essential*	*Desirable*	*Rarely used*	*Not applicable*
G31	Acquire ability to bear stress.				
G32	Use Negotiation.				
G33	Maintain various process equipment.				
G34	Calibrate process Instruments.				
G35	WHAT LEVEL OF MATHEMATICS A DIPLOMA INST.&CONTROL ENGG IS EXPECTED TO PERFORM DUTIES OF INSTRU. TECHNICIAN ? upto 10^{th} or higher?				
G36	WHAT LEVEL OF BASIC PHYSICS ARE NEEDED TO PERFORM DUTIES OF INSTRU. TECHNICIAN ? upto 10^{th} or higher?				
G37	WHAT LEVEL OF BASIC CHEMISTRY ARE NEEDED TO PERFORM DUTIES OF INSTRU. TECHNICIAN ? upto 10^{th} or higher?				
G38	WHAT DEGREE OF TECHNICAL COMMUNICATION WRITTEN / SPOKEN REQUIRED ? upto 10^{th} or higher?				
G39	Does Instru. Technician need to perform fire , disaster , first aid , burns , electrical shock procedures as certified level?				
G40					
G41					
G42					
G43					
G44					

State the job functions of engineering diploma holders in the initial five years after joining your organization from the polytechnic. For your ready reference one example is given and you may provide the remaining.

1. …… 7. ……..
2. …… 8. ……..
3. …… 9. ……..
4. …… 10. ……..
5. ……... 11. ……..
6. ……. 12. ……..

Table - 3

List the major instrumentation engineering equipment used in your industry

S. No.	**Name of the equipment/Instrument**	**Broad specifications (type/rating)**
1		
2		
3		
4		

Table - 4

State the career growth opportunity for an average engineering diploma holder

Designation	*Example:* Junior Engineer (or Technician)					
Years of Experience required to reach the position	at Entry Level	After 3 years	After 6 years	After 10 years	After 15 years	After 20 years

Do you think that industrial training must be provided to the students as an integral part of the curriculum? Yes / No.

a) If yes, for how many months? One/ Two/ Three/ Six Months.....

b) If yes, in which semester/s the industrial practical training need to be included?

Signature:……..

Name & Designation of person responding:……..

Phone:

Mobile

Email:

Thank you very much for your valuable responses.

Dr. Akshai Aggarwal

Vice Chancellor

Gujarat Technological University