STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN
(NATIONAL OCCUPATIONAL SKILLS STANDARD)

MC-091-2:2016

INDUSTRIAL AUTOMATION ENGINEERING SERVICES

LEVEL 2

JPK

Jabatan Pembangunan Kemahiran
Kementerian Sumber Manusia, Malaysia

Department of Skills Development (DSD)

Ministry of Human Resources

62530 PUTRAJAYA, MALAYSIA

STANDARD KEMAHIRAN PEKERJAAN KEBANGSAAN

(NATIONAL OCCUPATIONAL SKILLS STANDARD)

FOR

INDUSTRIAL AUTOMATION ENGINEERING SERVICES

LEVEL 2

TABLE OF CONTENTS

STANDARD PRACTICE

NATIONAL OCCUPATIONAL SKILLS STANDARD (NOSS) FOR:

INDUSTRIAL AUTOMATION ENGINEERING SERVICES

LEVEL 2

1. INTRODUCTION

1.1 Occupation overview

Malaysia has the potential to be a major regional producer and exporter of machinery and equipment. During the IMP3 period, investment for the industry have been targeted at RM 30.8 billion, while export are targeted to grow at an average annual rate of 6.7 percent to RM 48.3 billion in 2020.

In order to achieve the target the Third Industrial Master Plan (IMP3) has set six strategic thrusts for further development of the M&E industry;

- Promoting Malaysia as a regional production, trading and distribution centre for machinery and equipment
- Intensifying the development and promotion of selected specialised and high technology machinery and equipment
- Strengthening the engineering support industries and support services
- Developing Malaysian Standards for machinery and equipment
- Developing sufficient highly skilled workforce
- Strengthening the institutional support for the further development of the industry

It is clearly stated that developing sufficient highly skilled workforce is one of the strategic thrust focussing on developing human capital targeting highly skilled workforce to meet industry's expectation.

Economic Transformation Programme (ETP) Electrical & Electronic Sector is expecting GNI of RM 53.4 billion for the year 2020 and create 157,000 additional job. Presently, there are 207 companies producing a wide range of specialised machinery and equipment for the manufacturing and agriculture sectors. Within the manufacturing sector, the growth of the machinery and equipment industry was largely driven by the demands of E&E, telecommunications, agro-based and food processing industries. Presently, Malaysia is the leading manufacturer of automation equipment for the E&E industry in the Association of Southeast Asian Nations (ASEAN) region. There are 20 companies in operation, producing advanced handling system, with full automation and incorporating intelligent robots.

The NOSS for Industrial Automation Engineering Services is a discipline that comprises of knowledge, skills and attitude from various engineering fields, which include electronic, electrical, mechanical, fundamental control programming, and fabrication. The establishment of industrial automation system has stabilized the productions that previously depended upon the volatile human labors. With the automation system, the ability in maintaining the production standards due to the elimination of exhaustion and emotional factors in the systems itself is higher.

The Industrial Automation Engineering Services personnel are the technicians who are responsible for the industrial automation engineering support service functions in organizations. The role of the incumbent is to ensure the administration and execution of the support service functions is well-organized in order to achieve the departmental objectives and organizational mission and vision as a whole. It is the requirement for the incumbent to have the industrial automation related engineering skills, knowledge and attitude.

This NOSS development refers to occupational area structure and begins with level 2. The NOSS for level 1 (junior technician) has been embedded with level 2 (technician). This merging process is possible due to similar work nature, task, and responsibilities.

1.2 Justification and rational of NOSS development

The rational of reviewing this NOSS document is to furnish the essential enquiry by the Industrial Automation Services Industry for the purpose of benchmarking and most of all for the purpose of conducting training for future generation. There is a need for the industry to produce high quality, professional and well trained Industrial Automation Services Technologist to undertake the employment opportunities in the industry. The existing NOSS MC-091-2:2013 was initially developed in 2013. The revision of the existing NOSS (Industrial Automation Support Services Level 2) is carried out to review the relevancy and fulfil the current requirement of knowledge and skill of a Industrial Automation Services Technologist.

The panel of experts confirmed that the level of competency of the previous NOSS is too advanced and not align in view of the current needs of industry. The occupation emphasizes specialised skills requirements to match industry expectation. In acquiring these skills, requires long period working exposure. The Industrial Automation Services Industry has been growing annually and its demand for Industrial Automation Services Technologist profession has to be increased. This expertise will enhance the industry and also to overcome the future professionalism in this field.

1.3 Regulatory / statutory body requirements for employment

None

1.4 Occupational pre-requisite

None

2. OCCUPATIONAL STRUCTURE

2.1 OCCUPATIONAL STRUCTURE

SECTOR	MACHINERY & EQUIPMENT		
SUB-SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC		
JOB AREA	MECHATRONIC	INDUSTRIAL AUTOMATION ENGINEERING	ROBOTIC TECHNOLOGY
Level 5	MECHATRONIC TECHNOLOGIST	INDUSTRIAL AUTOMATION ENGINEERING TECHNOLOGIST	ROBOTIC TECHNOLOGIST
Level 4	ASSISTANT MECHATRONIC TECHNOLOGIST	ASSISTANT INDUSTRIAL AUTOMATION ENGINEERING TECHNOLOGIST	ASSISTANT ROBOTIC TECHNOLOGIST
Level 3	SENIOR TECHNICIAN		
Level 2	TECHNICIAN		
Level 1	JUNIOR TECHNICIAN		

Figure 1.0 Occupational Structure for Industrial Automation Engineering Services (Level 2)

2.2 OCCUPATIONAL AREA STRUCTURE

SECTOR	MACHINERY & EQUIPMENT		
SUB-SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC		
JOB AREA	MECHATRONIC	INDUSTRIAL AUTOMATION ENGINEERING	ROBOTIC TECHNOLOGY
Level 5	INDUSTRIAL AUTOMATION ENGINEERING SYSTEMS DEVELOPMENT		
Level 4	INDUSTRIAL AUTOMATION ENGINEERING SYSTEMS SUPPORT		
Level 3	INDUSTRIAL AUTOMATION ENGINEERING SYSTEMS ASSEMBLY		
Level 2	INDUSTRIAL AUTOMATION ENGINEERING SERVICES		
Level 1	EMBEDDED TO LEVEL 2		

Figure 1.1 Occupational Area Structure for Industrial Automation Engineering Services (Level 2)

3. DEFINITION OF COMPETENCY LEVELS

The NOSS is developed for various occupational areas. Candidates for certification must be assessed and trained at certain levels to substantiate competencies. Below is a guideline of each NOSS Level as defined by the Department of Skills Development, Ministry of Human Resources, Malaysia.

Level 1	Competent in performing a range of varied work activities, most of which are routine and predictable.
Level 2	Competent in performing a significant range of varied work activities, performed in a variety of contexts. Some of the activities are non-routine and required individual responsibility and autonomy.
Level 3	Competent in performing a broad range of varied work activities, performed in a variety of contexts, most of which are complex and non-routine. There is considerable responsibility and autonomy and control or guidance of others is often required
Level 4	Competent in performing a broad range of complex technical or professional work activities performed in a wide variety of contexts and with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and allocation of resources is often present.
Level 5	Competent in applying a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts. Very substantial personal autonomy and often significant responsibility for the work of others and for the allocation of substantial resources features strongly, as do personal accountabilities for analysis, diagnosis, planning, execution and evaluation.

4. AWARD OF CERTIFICATE

The Director General shall award to any person upon completing successfully the NOSS program following skills level qualifications;

a) Malaysian Skills Certificate / *Sijil Kemahiran Malaysia* (SKM) Level 1, Level 2 and Level 3

b) Malaysian Skills Diploma / *Diploma Kemahiran Malaysia* (DKM) Level 4

c) Malaysian Skills Advanced Diploma / *Diploma Lanjutan Kemahiran Malaysia* (DLKM) Level 5

d) Statement of Achievement / *Penyata Pencapaian* (PC)

No person shall be awarded a certificate unless they satisfies the requirements set by Malaysian Skills Certification System.

5. OCCUPATIONAL COMPETENCIES

Industrial Automation Engineering Services (Level 2) personnel are competent in performing the following core competencies:

- Industrial Automation Engineering Drawing
- Industrial Automation Fundamental Control Programming
- Industrial Automation Fabrication
- Industrial Automation Sub-Assembling
- Industrial Automation Systems Servicing

6. WORKING CONDITION

Incumbents in this field work in various environments that include the workshop and plant environment; in implementing the Industrial Automation Engineering Services functions. They will be in the factory or worksite environment that is exposed to installation, maintenance and recovery works following where the equipment and automation system are fitted and needed

The incumbent for this position belongs to the front line support group of the organisation. Incumbent is required to possess the following skills and qualities in order to be effective:

- Self Discipline
- Interpersonal skills
- Technical skills
- Informative
- Creative
- imaginative
- Proactive

Similar to other organization members, Industrial Automation Engineering Services incumbent must uphold the goals and vision of the organisation. This requires the incumbent to have knowledge of the business of the organisation.

Industrial Automation Engineering Services incumbent is also required to meet clients, visit the production floor, construction sites, the areas of maintenance and or targeted project in order to get information, check and investigate manufacturing and or service operational cases. This will expose the incumbent to unforeseen circumstances. Industrial Automation Engineering Services incumbent must be geared to face various job situations.

7. EMPLOYMENT PROSPECTS

Individual who hunts for a challenging career with higher rate of employability is suitable to venture into this field. The incumbent ought to be creative, imaginative and proactive in utilizing industrial automation technology to support solving industrial problems. Given that the industrial automation affects the whole operations, incumbents should be responsible and committed in their jobs.

From the career point of view, incumbents in this field always face new challenges, which urged them to continue to explore new experience and knowledge at work placed and share experience with peers and colleague from other organization when facing fresh unique problem from time to time. These factors increase the mind's activeness and stop the occurrence of career exhaustion. Incumbents become relevant and preferable with their constants involvement in this area

The demands for Industrial Automation Engineering Services incumbents remain high and will continue to be so in line with the economic growth. It covers sectors in engineering services, manufacturing, infrastructure, transportation, water supply, oil & gas, agriculture, medical, marine, construction etc. The demands became the impeller factor for its development through the SKM certification.

The Government’s effort to steadily strengthen our country’s growing economy under the economic transformation programme forms a guarantee and promising future for

Malaysia citizen. And the benefits are enjoyed by most workforce and businessmen in Malaysia. The industry growth rate continues to leap and the trend is predicted to stay positive for the upcoming five to ten years. This economic growth is directly proportional with the high demand of skilled workers and professional workers including for to Industrial Automation Engineering Services personnel. This development further enlivened with the increase of foreign investors' entry. Foreign investors bring in vast and high-tech investments. These factors have urged the growth of high skilled, semi and professional workers such as the Industrial Automation Engineering Services incumbents.

Individuals who have endeavoured into this area have promising future and wider career path should they work hard, honestly, and apply competencies as part of their lives culture.

The incumbents shall be able to further their training and enhance their skills by following higher level SKM programs or similar programs by other recognized professional bodies and higher learning institution within and outside of the country.

8. CAREER ADVANCEMENT

Candidates are trained in training institutions both in the public and private sectors. The basic qualifications for Industrial Automation Engineering are those who have completed SKM Industrial Automation Engineering Services (Level 2). A person who has completed Level 2 is eligible to continue to Level 3. Upon completion of Level 3, the person can proceed to Level 4. They can pursue to Level 5 upon completion of Level 4. As for career advancement, normally they learn their additional skills on the job. Trainees acquire working experience by observing and assisting experienced workers and formal training programmes.

9. SOURCES OF ADDITIONAL INFORMATION

- **Malaysia Automation Technology Association**
  Wisma FMM, No. 3, Persiaran Dagang, PJU 9
  Bandar Sri Damansara
  52200 Kuala Lumpur
  Tel: +603-6286 7200 Fax: 603-6277 6714
- **Malaysia Society for Engineering and Technology**
  Level 2, Blok 4,
  Faculty of Engineering,
  Universiti Putra Malaysia,
  43400 Serdang, Selangor
  Tel: +603-8946 6451
- **Board of Engineers Malaysia**
  Tingkat 17 Ibu Pejabat JKR
  Jalan Sultan Salahuddin
  50580 Kuala Lumpur

  Tel: +603-2692 5017

10. ACKNOWLEDGEMENT

The Director General of Department of Skills Development (DSD) would like to extend his gratitude to the organisations and individuals who have been involved in developing this standard, especially members of Standard Technical Evaluation Committee (STEC) for validated this document;

No	NAME	ORGANISATION
1	SHAH RIZAL BIN DAHLAN	**PETROLIAM NASIONAL BERHAD (PETRONAS** Group Technical Solution, Technology and Engineering Division, Level 15, Menara Dayabumi, Jalan Sultan Hishamuddin, 50050 Kuala Lumpur.
2	LOGANATHAN ALAGAN	**MATROLL SOLUTIONS** 402, Block B, Paradesa Rustica, Bandar Sri Damansara, 52200 Kuala Lumpur.
3	SHAMSUL BIN ZAKARIA	**SIRIM BERHAD** Lot PT 5285, Lebuhraya Sg. Besi – Puchong, 57000 Sungai Besi, Kuala Lumpur
4	LUQMAAN BIN AHMAD ZAIDI	**SIRIM BERHAD** Lot PT 5285, Lebuhraya Sg. Besi – Puchong, 57000 Sungai Besi, Kuala Lumpur

11. NOSS DEVELOPMENT COMMITTEE MEMBERS

COMMITTEE MEMBERS FOR INDUSTRIAL AUTOMATION ENGINEERING SERVICES (LEVEL 2)		
1.	En. Suhaimi bin Hj Ujang	Manager Jobs For Robotics Enterprise, Seremban
2.	Dr. Muhammad Fahmi bin Miskon	Senior Lecturer UTEM, Melaka
3.	En. Ong Joo Hun	Vocational Training Officer ILP Nibong Tebal
4.	En. Aminuddin bin Mohd Tayeb	Manager Easy Technology Group, Shah Alam
5.	En. Herman Hisham bin Nor Hashim	Manager Festech Sdn Bhd, Puchong
6.	En. Mohd Hezir bin Mohd Amin	Pegawai Latihan Vokasional IKTBN Sepang
7.	Sh. Norhasmadi bin Sh. Ali	Process Technology Manager Vacuumschmelze (M) Sdn Bhd, Pekan
8.	Syed Nizam bin Syed Idris	Head of Section German-Malaysian Institute, Kajang
9.	En. Mohd Sayuti bin Mohd Salim	Vocational Training Officer ADTEC Kulim
10.	En. Kantan A/L Saminathan	Vocational Training Officer ADTEC Batu Pahat
11.	En. Hairi bin Osman	Technical Specialist Infineon Technologies (Kulim) Sdn Bhd
12.	En. Samsi bin Md Said	Senior Lecturer Unikl-MFI
13.	En. Vikneswaran A/L Muniandy	Control Engineer Kanchana Control Engineering, Bukit Mertajam
14.	En. Ng Tong Koang	Technical Manager Institut Wawasan Kulim
15.	En. Mohd Fadzlisyam bin Sairan	Vocational Training Officer ADTEC Kulim
16.	En. Ho Weoi Loong	Vocational Training Officer ADTEC Taiping
17.	Dr. Muhammad Herman bin Jamaluddin	Senior Lecturer UTeM, Melaka
18.	En. Thillainathan A/L Subramaniam	Manager Perak Entrepreneur Skills Development Centre, Pusing

19.	Dr. Fariz bin Ali @ Ibrahim	Senior Lecturer UTeM, Melaka
20.	En. Norashid bin Ramli	Manager Daisis Technology Sdn Bhd, Puchong
21.	En. P. Manickavasagam A/L S.K. Palaniyandy	Manager VIS Mechatronic Sdn Bhd, Shah Alam
22.	En. Mohd Faizal Praphakeren	Head Of Department Institut Kemahiran Industri Melaka
23.	En. Ahmad Zubir bin Jamil	Senior Lecturer Universiti Teknikal Malaysia Melaka (UTeM)
24.	Dr. Tengku Mohd Azahar bin Tuan Dir	Associate Professor Unikl-MFI
FACILITATOR		
1.	Tn. Hj. Razalee bin Che Ros	JPK Cyberjaya
2.	En. Jefrizain bin Abdul Rasid	JPK Cyberjaya

COMPETENCY PROFILE CHART (CPC)

SECTOR	**MACHINERY & EQUIPMENT**		
SUB SECTOR	**INDUSTRIAL AUTOMATION & MECHATRONIC**		
JOB AREA	**MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY**		
NOSS TITLE	**INDUSTRIAL AUTOMATION ENGINEERING SERVICES**		
NOSS LEVEL	**2 (TWO)**	**NOSS CODE**	**MC-091-2:2016**

COMPETENCY	**COMPETENCY UNIT**			
CORE	**INDUSTRIAL AUTOMATION ENGINEERING DRAWING** **MC-091-2:2016-C01**	**INDUSTRIAL AUTOMATION FUNDAMENTAL CONTROL PROGRAMMING** **MC-091-2:2016-C02**	**INDUSTRIAL AUTOMATION FABRICATION** **MC-091-2:2016-C03**	**INDUSTRIAL AUTOMATION SUB-ASSEMBLING** **MC-091-2:2016-C04**
	INDUSTRIAL AUTOMATION SYSTEMS SERVICING **MC-091-2:2016-C05**			

COMPETENCY PROFILE (CP)

SECTOR	**MACHINERY & EQUIPMENT**		
SUB SECTOR	**INDUSTRIAL AUTOMATION & MECHATRONIC**		
JOB AREA	**MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY**		
NOSS TITLE	**INDUSTRIAL AUTOMATION ENGINEERING SERVICES**		
LEVEL	**2 (TWO)**	**NOSS CODE**	**MC-091-2:2016**

CU Title	CU Code	CU Descriptor	CU Work Activities	Performance Criteria
1. INDUSTRIAL AUTOMATION ENGINEERING DRAWING	MC-091-2: 2016-C01	Industrial automation engineering drawing is a process of generating plans that are visually communicated on how industrial automation systems function or has to be constructed. It should be done using accurate information as it is used in the visual communication media of interested parties and in job context, social, business and legislation. It must comply with international standard practice. It is compulsory to produce Industrial automation engineering drawing using accurate information as inaccurate information may cause deflection in ideology,	1. Perform industrial automation engineering sketching	1.1 Industrial automation engineering sketching instruction identified in accordance with company procedure. 1.2 Types of sketching drawing identified (mechanical and electrical drawing) in accordance with work order 1.3 Industrial automation engineering sketching requirements prepared in accordance with work order. 1.4 Industrial automation engineering parts sketched in accordance with job specifications. 1.4 Industrial automation engineering sketching compiled in according with company

		end products specification and construction that are detrimental and costly. The personnel who is competent in industrial automation engineering drawing will be able to perform industrial automation engineering sketching, perform two dimensional (2D) industrial automation engineering drawing development, perform three dimensional (3D) industrial automation engineering drawing development, prepare industrial automation drawing Bill of Materials and perform industrial automation engineering drawing filing in accordance with engineering drawing requirements. The outcome of this competency is to ensure high quality engineering drawing being produced in accordance with engineering drawing specification and requirement.	2. Perform two dimensional (2D) industrial automation engineering drawing development 3. Perform three dimensional (3D) industrial automation engineering drawing development	procedure. 2.1 2D industrial automation drawing requirements prepared in accordance with drawing specification. 2.2 2D dimensional drawing developed in accordance with 2D engineering drawing specifications. 2.3 2D dimensional drawing obtained in accordance with 2D engineering drawing specifications. 2.4 2D dimensional drawing updated in accordance with 2D engineering drawing specifications. 3.1 3D industrial automation drawing requirements prepared in accordance with engineering drawing specifications. 3.2 Industrial automation engineering isometric drawing developed in accordance with engineering drawing specifications. 3.3 Industrial automation engineering orthographic drawing developed in accordance with engineering drawing specifications. 3.4 Industrial automation engineering drawing record

				updated in accordance with engineering drawing specifications.
			4. Prepare industrial automation drawing Bill of Materials	4.1 Industrial automation engineering assembly drawing obtained in accordance with detail drawing. 4.2 Industrial automation engineering drawing parts list checked in accordance with part drawing. 4.3 Industrial automation engineering drawing bill of Materials produced in accordance with part drawing.
			5. Perform industrial automation engineering drawing filing	5.1 Industrial automation engineering drawing filing requirements prepared in accordance with company procedure. 5.2 Industrial automation engineering drawing indexed in accordance with company procedure. 5.3 Industrial automation engineering drawing stored in accordance with company procedure. 5.4 Industrial automation engineering drawing filing recorded in accordance with company procedure.

2. INDUSTRIAL AUTOMATION FUNDAMENTAL CONTROL PROGRAMMING	MC-091-2: 2016-C02	Industrial automation fundamental control programming is an activity of coding a control system. This include control device identification, understanding the process flow and characteristics of industrial automation control system, selecting suitable program language, programming, testing and debugging. The person who is competent in industrial automation fundamental control programming will be able to prepare Industrial Automation Control Systems software setup requirements, prepare Industrial Automation Control Systems hardware setup requirements, review characteristics of Industrial Automation Control System, perform Industrial Automation Control Systems Programming, testing and debugging and perform industrial automation product delivery preparation.	1. Prepare Industrial Automation Control Systems software setup requirements 2. Prepare Industrial Automation Control Systems hardware setup requirements 3. Review Characteristics of Industrial Automation Control System	1.1 Automation Control Systems software programming work order identified and explained. 1.2 Control Systems software specifications prepared. 1.3 Control Systems and software programming tools installed and communication established. 2.1 Automation Control Systems hardware device listed, installation and wiring of the hardware system identified and explained. 2.2 Control Systems hardware specifications which include power supply, voltage selection, and current consumption listed and presented. 2.3 Control Systems hardware tools and schematic diagram explained. 3.1. Various types of controllers, software and I/O components identified. 3.2. Flowchart of industrial automation control system

		The outcome of this CU is to ensure a stable system which resulted in higher productivity, consistent output and lower operating cost in accordance with manufacturer instruction manual.		developed and explained. 3.3. Operating characteristics of sensor and actuator technologies identified.
			4. Perform Industrial Automation Control Systems Programming	4.1 Programming language such as Ladder diagram, Instruction list or Sequential Function Chart identified in accordance with system requirement. 4.2 Input/output allocation list and addressing assigned in accordance with system requirement. 4.3 Control Systems program developed in according with process flow.
			5. Testing and debugging	5.1. Input/output physical wiring tested and confirmed in accordance with system design. 5.2. Program sequence verified in accordance with process flow. 5.3. Program execution simulated in accordance with process flow. 5.4. Program faulty identified and debugged in accordance with manual specification.
			6. Perform industrial automation product delivery preparation	6.1 Industrial Automation System Hand Over product documentation prepared (hardware/ software) in accordance with company

				procedure. 6.2 Industrial Automation System Hand Over log book updated in accordance with company policy and procedure.
3. INDUSTRIAL AUTOMATION FABRICATION	MC-091-2: 2016-C03	Industrial automation fabrication is a process of making product or component of industrial automation involving machining, cutting, bolting bending, folding, soldering, welding, brazing and riveting a piece of metal to form the desired finished product. The person who is competent in industrial automation fabrication will be able to prepare industrial automation fabrication requirements, perform cutting process. (Power Saw, Bench Saw, Punching, Shearing, Oxy cut), perform machining process. (milling, surface grinding, lathe, drilling), perform joining process. (welding, fastener, riveting, soldering, coupling, bonding) and perform industrial automation fabrication product delivery preparation. The outcome of this CU is to ensure the industrial	1 Prepare industrial automation fabrication requirements 2 Perform cutting process. (Power Saw, Bench Saw, Punching, Shearing, Oxy cut) 3 Perform machining	1.1 Industrial Automation Fabrication drawing obtained (detail drawing, dimension, tolerance) in accordance with detail drawing. 1.2 Industrial Automation fabrication specification obtained in accordance with design specification. 1.3 Process tools identified in accordance with machine shop procedure. 2.1 Cutting machine selected in accordance with work order. 2.2 Cutting machine parameter set in accordance with manual specifications. 2.3 Cutting process performed in accordance with details drawing. 2.4 Cutting quality checked in accordance with details drawing. 3.1 Machining process requirement

		automation systems fabrication of components are formed and produce neatly, accurately, functional, safe and ready for installation with cost optimization, low scrap value, optimum labor utilization and within a given time frame according to manufacturer specifications.	process. (Milling, surface grinding, lathe, drilling)	prepared in accordance with job specifications. 3.2 Type of machine selected in accordance with work order. 3.3 Machine parameter set in accordance with manual specifications. 3.4 Machining process performed in accordance with details drawing. 3.5 Machining quality checked in accordance with details drawing.
			4 Perform joining process. (welding, fastener, riveting, soldering, coupling, bonding)	4.1 Joining process requirements prepared in accordance with job specifications. 4.2 Type of joining machine / equipment selected in accordance with work order. 4.3 Joining parameter setting performed in accordance with manual specification. 4.4 Joining process executed in accordance with details drawing. 4.5 Joining quality checked in accordance with details drawing.
			5 Perform industrial automation fabrication product delivery preparation	5.1 Industrial automation systems fabrication product listing prepared in accordance with bill of materials.

				5.2 Industrial automation systems fabrication product tagging prepared in accordance with company specifications. 5.3 Industrial automation systems fabrication product documentation prepared in accordance with company specifications. 5.4 Industrial automation systems fabrication product documentation and drawing attached in accordance with company specifications. 5.5 Industrial automation systems fabrication log book updated in accordance with company specifications.
4. INDUSTRIAL AUTOMATION SUB - ASSEMBLY	MC-091-2: 2016-C04	Industrial automation sub-assembling is a competency of constructing, combining and or assembling pieces into a finished product or sub-assemblies product or component. The person who is competent in industrial automation sub-assembly will be able to prepare industrial automation system sub-assembly requirements, perform industrial automation electrical	1. Prepare industrial automation system sub-assembly requirements	1.1 Industrial automation system sub-assembly documentation obtained in accordance with assembly drawing. 1.2 Industrial automation system sub-assembly tool and equipment obtained in accordance with assembly drawing. 1.3 Industrial automation system Sub-Assembly Specifications details obtained in accordance with company specifications. 1.4 Personnel Protection Equipment acquired in

		installation, perform industrial automation electronic installation, perform industrial automation mechanical sub assembly and perform industrial automation pneumatic and hydraulic sub assembly. The outcome of this CU is to ensure automation system sub assembly work completed as per drawing specification, fully tested and function in good condition with integrate mechanically and electrically/electronically in accordance with manufacturer specification.		accordance with company specifications
			2. Perform industrial automation electrical sub-assembly	2.1 Electrical sub- assembly requirement prepared in accordance with job specification. 2.2 Electrical sub assembly process performed in accordance with job specification. 2.3 Industrial automation system electrical part and circuit functionality checked in accordance with design specification 2.4 Sub Assembly check list updated in accordance with company specifications
			3. Perform industrial automation electronic sub assembly	3.1 Electronic sub- assembly requirement prepared in accordance with job specification. 3.2 Electronic installation process performed in accordance with job specification. 3.3 Electronic part and circuit functionality checked in accordance with design specification 3.4 Installation record systems updated in accordance with

				company specifications.
			4. Perform industrial automation mechanical sub assembly	4.1 Mechanical Part and Structure requirement prepared in accordance with job specification. 4.2 Mechanical Part and Structure installation process performed in accordance with job specification. 4.3 Mechanical Part and Structure functionality checked in accordance with design specification 4.4 Installation record systems updated in accordance with company specifications. 4.5 Installation tools and equipments obtained in accordance with work order.
			5. Perform industrial automation pneumatic and hydraulic sub assembly	5.1 Pneumatic or hydraulic part installation process carried out in accordance with schematic diagram. 5.2 Functionality test (air supply, reservoir tank) performed in accordance with design specifications. 5.3 Corrective installation record updated in accordance with company specifications. 5.4 Industrial automation system

				trial run record prepared in accordance with company specifications. 5.5 Industrial automation system trial run record generated in accordance with company specifications. 5.6 Industrial automation system trial run record submitted in accordance with company specifications.
5. INDUSTRIAL AUTOMATION SYSTEMS SERVICING	MC-091-2: 2016-C05	Industrial Automation Systems servicing is the ability of restoring or retaining industrial automation systems, equipments, machineries, components, and or any related devices to the specified efficiency level for achieving the optimum economic capacity and prolong service time. The person who is competent in industrial automation systems servicing will be able to prepare industrial automation systems servicing requirements, perform industrial automation system mechanical servicing, perform industrial automation system electrical servicing and perform industrial automation system	1. Prepare industrial automation systems servicing requirements 2. Perform industrial	1.1 Industrial automation system maintenance specification obtained in accordance with manual specifications. 1.2 Industrial automation system maintenance standard operation procedure obtained in accordance with manual specifications. 1.3 Corrective maintenance standard operating procedure gathered in accordance with manual specifications. 1.4 Corrective action requisition procedure obtained in accordance with work order. 1.5 Corrective action frequency obtained in accordance with maintenance check list. 2.1 Routine maintenance (oil level,

		pneumatic and hydraulic servicing. The outcome of this CU is to ensure the industrial automation servicing perform well during breakdowns, reduce operation idle time and minimize the stoppage interferences records which optimize overall maintenance cost. The technician is also responsible to achieve his individual and team performance objectives and contribute toward the highest achievement of the operation in accordance with the organization requirements.	automation system mechanical servicing	belt tension, grease oil schedule) performed in accordance with maintenance schedule. 2.2 Corrective action requisition responded in accordance with maintenance check list. 2.3 Tools and facilities prepared in accordance with work order. 2.4 Faulty parts / components recognised in accordance with product specification. 2.5 Faulty parts / components dismantled in accordance with manual specification. 2.6 Faulty part / components replaced in accordance with manual specifications. 2.7 Mechanical test conducted in accordance with manual specifications. 2.8 Log book updated in accordance with company specifications.
			3. Perform industrial automation system electrical servicing	3.1 Corrective action requisition interpreted in accordance with maintenance check list 3.2 Tools and equipment prepared in accordance with work order. 3.3 Industrial automation system electrical servicing method performed in accordance with

				maintenance schedule. 3.4 Faulty parts / components recognised in accordance with product specification. 3.5 Faulty part / components replaced in accordance with manual specifications. 3.6 Functionality test conducted in accordance with manual specifications. 3.7 Log book updated in accordance with company specifications.
			4. Perform industrial automation system electronic servicing	4.1 Corrective action requisition interpreted in accordance with maintenance check list 4.2 Tools and equipment prepared in accordance with work order. 4.3 Industrial automation system electrical servicing method performed in accordance with maintenance schedule. 4.4 Faulty parts / components recognised in accordance with product specification. 4.5 Faulty part / components replaced in accordance with manual specifications. 4.6 Functionality test conducted in accordance with manual specifications. 4.7 Log book updated in accordance with company

				specifications.
			5. Perform industrial automation system pneumatic and hydraulic servicing	5.1 Routine maintenance (air and oil leakage, oil level, tubing and connecting) performed in accordance with maintenance schedule. 5.2 Corrective action requisition responded in accordance with maintenance check list. 5.3 Tools and facilities prepared in accordance with work order. 5.4 Faulty parts / components recognised in accordance with product specification. 5.5 Faulty parts / components dismantled in accordance with manual specification. 5.6 Faulty part / components replaced in accordance with manual specifications. 5.7 Functionality test conducted in accordance with manual specifications. 5.8 Log book updated in accordance with company specifications.

CURRICULUM OF COMPETENCY UNIT (CoCU)

SECTOR	MACHINERY & EQUIPMENT						
SUB SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC						
JOB AREA	MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY						
NOSS TITLE	INDUSTRIAL AUTOMATION ENGINEERING SERVICES						
COMPETENCY UNIT TITLE	INDUSTRIAL AUTOMATION ENGINEERING DRAWING						
PRE-REQUISITE (if appreciable)	-						
LEARNING OUTCOMES	The outcome of this competency is to ensure high quality engineering drawing being produced in accordance with engineering drawing specification and requirement. Upon completion of this competency unit, trainees will be able to : 1. Perform industrial automation engineering sketching 2. Perform two dimensional (2D) industrial automation engineering drawing development 3. Perform three dimensional (3D) industrial automation engineering drawing development 4. Prepare industrial automation drawing bill of materials 5. Perform industrial automation engineering drawing filing						
COMPETENCY UNIT ID	MC-091-2:2016-C01	**LEVEL**	2	**TRAINING DURATION**	160 Hours	**SKILLS CREDIT**	16.0

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Perform industrial automation engineering sketching	1.1 Industrial automation engineering sketching instruction details • Instruction source • Instruction authority • Instruction objective. • Instruction content • Imposed condition • Instruction validity • Engineering Drawing Sketching instruction acceptance. 1.2 Pre-sketching requirements preparation • Types of drawing (mechanical & electrical drawing) • Sketching requirement information. • Engineering drawing sketching objectives determinants. • Engineering drawing sketching	1.1 Check Industrial automation engineering sketching instruction 1.2 Prepare Sketching requirements. 1.3 Sketch Industrial automation engineering. 1.4 Compile sketching.	<u>Attitude:</u> i. Detail in examining engineering Drawing Sketching instruction ii. Objective focused in performing Pre- sketching requirements preparation. iii. Informative in carrying out engineering drawing sketching iv. Accurate in updating engineering drawing sketching record. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work	<u>Related Knowledge:</u> 3 <u>Related Skills:</u> 7	<u>Related Knowledge:</u> Lecture <u>Related Skills:</u> Demonstration, Practical	1.1 Industrial Automation Engineering Sketching, instruction details interpreted. 1.2 Industrial automation engineering pre-sketching requirements preparation arranged and presented. 1.3 Industrial Automation Engineering Sketching executed and presented. 1.4 Industrial Automation Engineering Sketching record produced and presented.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	time frame determinant. • Site exploration • In-situ measurements • Sketching concepts & orientation studies. • Sample visualization • Client interview • Sketching resources requirements • Engineering sketching tools, equipment and materials. • Engineering drawing sketching requirements summary. 1.3 Industrial Automation Engineering sketching activities • Customer requirements & specification • Product/object specification		methodology iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Actual sample visualisation • Actual object visualisation. • Engineering drawing sketching site visit and exploration. • Non-exist object sketching information gathering. • Sketching Object orientation • Sketching view angle selection. • Engineering drawing sketching resources • Engineering drawing sketching techniques application. • Engineering drawing sketching procedure • Engineering drawing sketching detail provision. • Engineering drawing sketching		iv. Practice recycle policy. v. Practice 5S activity.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	check & confirmation • Engineering drawing sketching record preparation 1.4 Industrial Automation Engineering Sketching record update. • Utilize Industrial Automation Engineering Sketching record format • Provide Industrial Automation Engineering Sketching record contents. • Apply Industrial Automation Engineering Sketching recording techniques • Follow Industrial Automation Engineering Sketching recording procedure					

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
2. Perform two dimensional (2D) industrial automation engineering drawing development	2.1 Two dimensional engineering drawing requirement procedure • Drawing Instruction • Types of drawing (mechanical & electrical drawing) • Paper size. • Drawing tools and equipment. • Drawing title block. • Drawing Scale. • Drawing Elevation (Plan, front and side view) • Geometric, Dimensioning and Tolerance (GD&T) • Drawing detail • Drawing submission. 2.2 Two dimension drawing development	2.1 Prepare 2D drawing requirements. 2.2 Develop 2D dimensional drawing. 2.3 Obtain product information. 2.4 Update 2D dimensional drawing record.	Attitude: i. Precise in developing two dimension engineering drawing ii. Precise in developing Two Dimension Sectional Drawing iii. Timely in carrying out two dimension sectional drawing submission vi. Accurate in updating engineering drawing record. Safety: i. Ensure data safety. ii. Ensure safe	Related Knowledge: 15 Related Skills: 28	Related Knowledge: Lecture Related Skills: Demonstration, Practical	2.1 Two dimensional industrial automation engineering drawing recognized and selected. 2.2 Two Dimensional Sectional industrial automation engineering drawing reviewed, produced and summited. 2.3 Two dimension al sectional industrial automation engineering drawing explained. 2.4 Industrial automation engineering drawing record prepared and demonstrated.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	procedure • Drawing name. • Drawing number. • Text style. • Sectional drawing view. • Area/section details. • Hatching. • Scale. • Title block/template. • Line type. 2.3 Drawing tools, equipment and material. • Catalogue, Manual and hand book. • Part/Object. • Material terminology. • Surface finish terminology. • Material treatment terminology. 2.4 Engineering drawing record documentation requirement • Engineering		work methodology . iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	drawing approval. • Engineering drawing record format • Engineering drawing record contents. • Engineering drawing recording procedure • Engineering drawing record generation.		paperless office. iv. Practice recycle policy			
3. Perform three dimensional (3D) industrial automation engineering drawing development	3.1 Industrial automation 3D Drawing requirements preparation. • Drawing Instruction. • Types of drawing (mechanical & electrical drawing) • Paper size. • Drawing title block. • Drawing Scale and Geometric Dimensioning. • Drawing tools and equipment. • Drawing	3.1 Prepare 3D drawing requirements. 3.2 Develop Isometric drawing 3.3 Develop Orthographic drawing. 3.4 Update Engineering drawing record	Attitude: i. Detail in examining three dimensional engineering drawing development instruction ii. Objective focused in developing Isometric Drawing iii. Objective focused in developing orthographic	Related Knowledge: 18 Related Skills: 42	Related Knowledge: Lecture Related Skills: Demonstration, Practical	3.1 Three dimensional industrial automation engineering drawing procedure selected and described. 3.2 Isometric industrial automation engineering drawing interpreted and drawn. 3.3 Orthographic industrial automation engineering drawing interpreted and drawn. 3.4 Industrial automation engineering drawing record updated and

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	submission. 3.2 Isometric drawing process development. • Base line. • Isometric angle. • Axis creation. • Isometric projection. • Isometric line & plane. • Isometric scale. • Isometric drawing technique. • Isometric circle and ellipse. • Labelling type, • Line type. • Isometric drawing positioning. • Sketch enclosed box. 3.3 Orthographic drawing development. • Orthographic drawing philosophy(6 views) • Orthographic drawing		drawing iv. Timely in carrying out two dimension sectional drawing submission v. Accurate in updating engineering drawing record. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology . iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations			checked.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	requirements • Orthographic drawing Scale and dimension. • Orthographic view drawing development (multi view and pictorial view). • Orthographic Drawing detail. • Orthographic drawing title block. 3.4 Engineering drawing record documentation requirement • Engineering drawing approval. • Engineering drawing record format • Engineering drawing record contents. • Engineering drawing recording procedure • Engineering drawing record generation.		v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office. iv. Practice recycle policy.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
4. Prepare industrial automation drawing bill of materials	4.1 Drawing bill of material procedure; • Instruction source • Instruction authority • Instruction objective. • Instruction content • Instruction validity 4.2 Drawing part list check. • Materials information list require. • Prescribed materials list. • Required materials quantification. • Required part detail &	4.1 Obtain drawing bill of material. 4.2 Check parts list. 4.3 Update bill of material record.	Attitude: i. Detail in examining Drawing Bill of Materials instruction ii. Meticulous in obtaining Drawing Bill of Materials requirements iii. Creative in creating component part balloon iv. Accurate in creating Bill of Materials table. v. Systematic in filing up updated	Related Knowledge: 9 Related Skills: 21	Related Knowledge: Lecture Related Skills: Demonstration, Practical	4.1 Drawing Bill of Materials checked and confirmed. 4.2 Bill of Materials table content updated and confirmed. 4.3 Industrial automation engineering drawing prepared and updated.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	specification • Required parts quantification. 4.3 Drawing bill of material record documentation requirement • Drawing Bill of Materials instruction specification • Drawing Bill of Materials requirements sources • Drawing bill of materials principles. • Targeted object specification. • Component part balloon specification • Component part balloon purposes. • Part list table contents (Part name, quantity, part materials and		drawing <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	size) 4.4 Update drawing bill of material filing.		energy wastage. iii. Practice paperless office. iv. Practice recycle policy.			
5. Perform industrial automation engineering drawing filing	5.1 Engineering Drawing Filing requirements • Drawing filing objectives. • Type of filing (Physical /electronic) • Drawing filing tools, equipment and materials. • Drawing filing indexing procedure. • Drawing filing procedure. • Drawing filing record • Drawing indexing register	5.1 Prepare industrial automation engineering drawing filing requirements 5.2 Index industrial automation engineering drawing. 5.3 Store industrial automation engineering drawing. 5.4 Record	Attitude: i. Detail in examining Engineering Drawing filing instruction ii. Detail in preparing Engineering Drawing Filing requirements iii. Accurate in performing drawing indexing iv. Systematic in carrying out physical drawing filing v. Systematic in	Related Knowledge: 3 Related Skills: 14	Related Knowledge: Lecture Related Skills: Demonstration, Practical	5.1 Industrial automation engineering drawing filing requirements procedure listed. 5.2 Industrial automation engineering drawing indexing performed and registered. 5.3 Industrial automation engineering drawing storage carried out and confirmed. 5.4 Industrial automation engineering drawing filing carried out and record produced.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	5.2 Drawing indexing procedure • revision identification number • Indexing detailing format. • Revised drawing version number • Date of produce/draw • Indexing method • Title and coding 5.3 Industrial automation engineering storage Procedure • Drawing approval • Drawing tagging / numbering technique. • Drawing movement check list. 5.4 Industrial automation engineering drawing filling.	industrial automation engineering drawing filing	carrying out digital drawing filing vi. Meticulous in performing Engineering Drawing filing retrieve/ issuance <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Drawing filing record accuracy. • Physical drawing movement record update. • Digital drawing filing requirement • Drawing title and coding. • Drawing classification and type. • Drawing files movement record update. • Drawing filing retrieve/ issuance condition		regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office. iv. Practice recycle policy			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes 01.03 Utilize basic IT applications 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/ telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read/interpret flowcharts and pictorial information 03.01 Apply cultural requirements to the workplace 03.02 Demonstrate integrity and apply ethical practices 03.03 Accept responsibility for own work and work area 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 06.01 Understand systems 06.02 Comply with and follow chain of command 06.03 Identify and highlight problems 06.04 Adapt competencies to new situations/systems 01.04 Analyse information 01.05 Utilize the Internet to locate and gather information 01.06 Utilize word processor to process information 02.06 Write memos and news 02.07 Utilize Local Area Network(LAN)/Internet to exchange information 02.08 Prepare pictorial and graphic information 03.08 Develop and maintain a cooperation within work group 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem solving strategies 04.05 Demonstrate initiative and flexibility 06.05 Analyse technical system 06.06 Monitor and correct performance of system	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

Tools, Equipment and Materials (TEM)

Items	Ratio (TEM: Trainee)
1. Computer Set with words processing & graphic application. 2. LCD Projector or any other projector with white screen 3. Drawing board 4. Drawing Instruments 5. Measuring Instrument	1:1 1:25 1:1 As required 1:1

REFERENCES

1. Frederick E. Giesecke, Alva E. Mitchell, Henry C. Spencer, Ivan L. Hill , John Thomas Dygdon ,James E. Novak , Shawna E. Lockhart , Prentice Hall; 13 edition (May 23, 2008), Technical Drawing (13th Edition), ISBN: 978-0135135273
2. Frederick E. Giesecke, Peachpit Press 1992, Principles of Technical Drawing, ISBN: 978-0023437359
3. John S. Rooke, IndyPublish.com, 2008, Textbook of Mechanical Drawing: Being an Explanation of the Principles of Geometry and Orthographic Projection, the Helix, and Toothed Gearing, ISBN: 9781437165753
4. Frederick E. Giesecke (Author), Ivan L. Hill (Author), Henry C. Spencer (Author), Alva E. Mitchell (Author), John Thomas Dygdon (Author), James E. Novak (Author), Shawna E. Lockhart (Author), Marla Goodman , Peachpit Press, 14 Ed, 2011, Technical Drawing with Engineering Graphics, ISBN: 978-0135090497

CURRICULUM OF COMPETENCY UNIT (CoCU)

SECTOR	MACHINERY & EQUIPMENT						
SUB SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC						
JOB AREA	MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY						
NOSS TITLE	INDUSTRIAL AUTOMATION ENGINEERING SERVICES						
COMPETENCY UNIT TITLE	INDUSTRIAL AUTOMATION FUNDAMENTAL CONTROL PROGRAMMING						
PRE-REQUISITE (if applicable)	-						
LEARNING OUTCOMES	The outcome of this CU is to ensure a stable system which resulted in higher productivity, consistent output and lower operating cost in accordance with manufacturer instruction manual. Upon completion of this competency unit, trainees will be able to : 1. Prepare Industrial Automation Control Systems software setup requirements 2. Prepare Industrial Automation Control Systems hardware setup requirements 3. Review Characteristics of Industrial Automation Control System 4. Perform Industrial Automation Control Systems Programming 5. Testing and debugging 6. Perform industrial automation product delivery preparation						
COMPETENCY UNIT ID	MC-091-2:2016-C02	**LEVEL**	2	**TRAINING DURATION**	160 Hours	**SKILLS CREDIT**	16.0

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Prepare Industrial Automation Control Systems software setup requirements	1.1 Automation Control Systems software requirements • Computer configuration • Software requirements 1.2 Software specification • Operating system • Computer specification. 1.3 Software programming tools requirements • Software installation • Communication between software and hardware.	1.1. Obtain Automation Control Systems software programming work order 1.2. Identify Control Systems software specifications 1.3. Obtain Control Systems and software programming tools	Attitude: i. Thorough in examining project requirements. ii. Detail in checking programming Software/hard ware specification iii. On time in coordinating work. Safety: i. Ensure data safety. ii. Ensure safe work methodology. Environment: i. Ensure energy saver office equipments. ii. Reduce energy wastage.	Related Knowledge: 6 Related Skills: 14	Related Knowledge: Lecture Related Skills: Demonstration, Practical	1.1 Automation Control Systems software programming work order identified and explained. 1.2 Control Systems software specifications prepared. 1.3 Control Systems and software programming tools installed and communication established.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			iii. Practice paperless office. iv. Practice recycle policy.			
2. Prepare Industrial Automation Control Systems hardware setup requirements	2.1 Automation Control Systems hardware requirement: • Hardware device • Installation and wiring of the hardware system 2.2 Hardware specifications: • Power supply • Voltage selection • Current consumption 2.3 Hardware installation and wiring tools requirement: • Interpret schematic diagram • Suitable tools usage	2.1 Obtain Automation Control Systems hardware work order. 2.2 Identify Control Systems hardware specifications. 2.3 Obtain Control Systems and hardware tools	<u>Attitude:</u> i. Ensure documents completeness ii. Task completion in given time. iii. To carry out the task according to standard procedure. <u>Safety:</u> i. Use proper tools and with care. <u>Environmental:</u> - nil	<u>Related Knowledge:</u> 6 <u>Related Skills:</u> 14	<u>Related Knowledge:</u> Lecture <u>Related Skills:</u> Observation, Demonstration and Practical	2.1 Automation Control Systems hardware device listed, installation and wiring of the hardware system identified and explained. 2.2 Control Systems hardware specifications which include power supply, voltage selection, and current consumption listed and presented. 2.3 Control Systems hardware tools and schematic diagram explained.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
3. Review Characteristics of Industrial Automation Control System	3.1. Automation control system concept and process information: • Automation control requirement and process • Characteristics of architecture 3.2. Industrial automation control system process flow chart • Input • Output • Process/operation • Condition 3.3. Control characteristic of industrial automation control system: • Sensor and actuator technology • Motion drives	3.1. Obtain overall view of automation control system concept and process information 3.2. Identify industrial automation control system behaviour 3.3. Determine the control characteristic of the industrial automation control system	Attitude: i. Detail in examining input requirements. ii. Detail in examining output requirements. iii. Meticulous in performing input/output addressing iv. On time in coordinating work. Safety: i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically	Related Knowledge: 6 Related Skills: 14	Related Knowledge: Lecture Related Skills: Demonstration, Practical	3.1. Various types of controllers, software and I/O components identified. 3.2. Flowchart of industrial automation control system developed and explained. 3.3. Operating characteristics of sensor and actuator technologies identified.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	and system controls technologies		powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office. iv. Practice recycle policy.			
4. Perform Industrial Automation	4.1 Programming concept and programming language.	4.1. Determine programming methods and	<u>Attitude:</u> i. Detail in examining	<u>Related Knowledge:</u>	<u>Related Knowledge:</u>	4.1. Programming language such as Ladder

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
Control Systems Programming	• Ladder Diagram • Instruction List • Sequential Function Chart • Statement List 4.2 Input/output configuration according to process flow: • Addressing input/output • Allocation list diagram 4.3 Develop program according to process flow. • Programming structure and concepts • Integration of Timer function block • Integration of Counter function block	software platform. 4.2. Configure input output allocation list and addressing. 4.3. Write program of the Control Systems	input/output address ii. Accurate in developing process algorithm. iii. On time in coordinating work. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good	18 <u>Related Skills:</u> 42	Lecture <u>Related Skills:</u> Observation, Demonstration and Practical	diagram, Instruction list or Sequential Function Chart identified. 4.2. Input/output allocation list and addressing assigned. 4.3. Control Systems program developed according to process flow.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office. Practice recycle policy.			
5. Testing and debugging	5.1. Check physical input/output wiring: • Continuity test • Voltage test 5.2. Programming validation • Step by step simulation (offline) • Single cycle simulation (offline) 5.3. Program execution • Errors message	5.1. Verify Input/output physical wiring. 5.2. Check Program accordance to sequence 5.3. Simulate Program execution	<u>Attitude:</u> i. Objective focused in determining Industrial Automation program errors. ii. Meticulous in preparing Industrial Automation programming	<u>Related Knowledge:</u> 9 <u>Related Skills:</u> 21	<u>Related Knowledge:</u> Lecture <u>Related Skills:</u> Demonstration, Practical	5.1. Input/output physical wiring tested and confirmed. 5.2. Program accordance to sequence verified 5.3. Program execution simulated 5.4. Program faulty

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	verification • Rectification of errors • Uploading program • Step by step simulation (online) • Single cycle simulation (online) • Input/output functionality verification. 5.4. Program debugging • Problem finding • Problem solving	5.4. Verify program if problem occur.	iii. On time in coordinating work. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office			identified and debugged

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			equipments. ii. Reduce energy wastage. iii. Practice paperless office. iv. Practice recycle policy.			
6. Perform industrial automation product delivery preparation	6.1. Industrial Automation System Hand Over product documentation • Process algorithm (process flow) • Electrical schematic diagram (Power diagram and Control diagram) • Input/output allocation list • Program list 6.2. Industrial Automation System Hand Over log book.	6.1. Prepare Industrial Automation System Hand Over product documentation (hardware/ software) 6.2. Update Industrial Automation System Hand Over log book	<u>Attitude:</u> i. Detail in preparing product documentation ii. On time in coordinating work. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment.	<u>Related Knowledge:</u> 3 <u>Related Skills:</u> 7	<u>Related Knowledge:</u> Lecture <u>Related Skills:</u> Demonstration, Practical	6.1. Industrial Automation System Hand Over product documentation (hardware/ software) prepared 6.2. Industrial Automation System Hand Over log book established

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office. iv. Practice recycle policy.			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes 01.03 Utilize basic IT applications 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/ telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read/interpret flowcharts and pictorial information 03.01 Apply cultural requirements to the workplace 03.02 Demonstrate integrity and apply ethical practices 03.03 Accept responsibility for own work and work area 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 06.01 Understand systems 06.02 Comply with and follow chain of command 06.03 Identify and highlight problems 06.04 Adapt competencies to new situations/systems 01.04 Analyse information 01.05 Utilize the Internet to locate and gather information 01.06 Utilize word processor to process information 02.06 Write memos and news 02.07 Utilize Local Area Network(LAN)/Internet to exchange information 02.08 Prepare pictorial and graphic information 03.08 Develop and maintain a cooperation within work group 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem solving strategies 04.05 Demonstrate initiative and flexibility 06.05 Analyse technical system 06.06 Monitor and correct performance of system	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

Tools, Equipment and Materials (TEM)

Items	Ratio (TEM: Trainee)
1. Computer Set & programming software. 2. LCD Projector or any other projector with white screen 3. PLC Training Kit (PLC, Switches, Sensors, Limit Switches, Motors, Cylinders, Solenoid valves) 4. Programming Cables & Accesories 5. Measuring Instrument	1:5 1:25 1:5 As required 1:5

REFERENCES

1. William Bolton, Newnes; 6 edition (March 17, 2015), Programmable Logic Controllers, ISBN: 978-0128029299
2. Terry Borden, Delmar Cengage Learning; 6 edition (January 27, 2012), Technician's Guide to Programmable Controllers, ISBN: 978-1111544096
3. Khaled Kamel, McGraw-Hill Education; 1 edition (September 4, 2013), Programmable Logic Controllers: Industrial Control, ISBN: 978-0071810456
4. S.J. Lin, Industrial Press (December 10, 2015), Programmable Logic Controllers, ISBN: 978-0831135072
5. Ronald A. Reis, Ronald A. Ries, Stephen Helba (Editor) John W. Webb, Prentice Hall Professional Technical Reference (August 28, 1994), Prentice Hall Professional Technical Reference (August 28, 1994), ASIN: B0089A779A
6. James A. Rehg (Author), Glenn J. Sartori (Author), Pearson; 2 edition (October 3, 2013), Programmable Logic Controllers: Pearson New International Edition, ASIN: B00IZ0QZE2
7. Pradip Dey (Author), Manas Ghosh (Author), Oxford University Press; 2 edition (August 31, 2013), Computer Fundamentals and Programming in C, ISBN-13: 978-0198084563
8. Michael Netzley & Graig Snow, Prentice Hall 1st. Ed. 2001, Guide to Report Writing ISBN 978-0130417718
9. John Bowden, Writing a Report- How to Accurate in preparing, Write & Present Really Effective, ISBN 978-1845284701

CURRICULUM OF COMPETENCY UNIT (CoCU)

SECTOR	MACHINERY & EQUIPMENT						
SUB SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC						
JOB AREA	MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY						
NOSS TITLE	INDUSTRIAL AUTOMATION ENGINEERING SERVICES						
COMPETENCY UNIT TITLE	INDUSTRIAL AUTOMATION FABRICATION						
PRE-REQUISITE (if appreciable)	-						
LEARNING OUTCOMES	The outcome of this CU is to ensure the industrial automation systems fabrication of components are formed and produce neatly, accurately, functional, safe and ready for installation with cost optimization, low scrap value, optimum labor utilization and within a given time frame according to manufacturer specifications. Upon completion of this competency unit, trainees will be able to: 1. Prepare industrial automation fabrication requirements 2. Perform cutting process (Power Saw, Bench Saw, Punching, Shearing, Oxy cut) 3. Perform machining process. (Milling, surface grinding, lathe, drilling) 4. Perform joining process. (welding, fastener, riveting, soldering, coupling, bonding) 5. Perform industrial automation fabrication product delivery preparation						
COMPETENCY UNIT ID	MC-091-2:2016-C03	**LEVEL**	2	**TRAINING DURATION**	160 Hours	**SKILLS CREDIT**	16.0

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Prepare industrial automation fabrication requirements	1.1 Industrial automation fabrication drawing; • Detail drawing • Dimension • Tolerance 1.2 Industrial Automation Fabrication specification • material • weight • hardness • quantity 1.3 Type of fabrication tools and equipment • Hand Tool • Power Tool • Special tool	1.1 Obtain Industrial Automation Fabrication drawing 1.2 Obtain Industrial Automation Fabrication specification 1.3 Identify Process tools	Attitude: i. Detail in checking Instruction source ii. Detail in checking instruction authority iii. Detail in checking instruction validity iv. Detail in checking instruction content v. Confidence in accepting industrial automation fabrication instruction vi. Accurate in recording industrial automation fabrication instruction Environment: i. Ensure energy	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	1.4 Industrial Automation Fabrication drawing selected and described 1.5 Industrial Automation Fabrication specification identified and explained 1.6 Fabrication tools and equipment selected and explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			
2. Perform cutting process. (Power Saw, Bench Saw, Punching, Shearing, Oxy cut)	2.1 Cutting machine selected. • Power saw • Bench saw • Punching • Shearing Machine • Oxy- Acetylene equipment 2.1 Set cutting machine parameter • Size • Speed • Rotation • Pressure 2.2 Perform cutting process. • Shear • Heat • Pressure 2.3 Check cutting quality	2.1 Select Cutting machine. 2.2 Set cutting machine parameter 2.3 Perform cutting process. 2.4 Check cutting quality	Attitude: i. Detail in checking Instruction source ii. Detail in checking instruction authority iii. Detail in checking instruction validity iv. Detail in checking instruction content v. Confidence in accepting industrial automation fabrication instruction	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	2.1 Cutting machine identified and explained 2.2 Cutting machine parameter adjusted 2.3 Cutting process applied 2.4 Cutting quality confirmed and evaluated

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Smooth • Sharpness • Accuracy • Tolerance • Dimension		vi. Accurate in recording industrial automation fabrication instruction <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			Environment: i. Control scrap wastage. ii. Reduce energy wastage. iii. Control cutting tools and liquids wastage.			
3. Perform machining process. (Milling, surface grinding, Lathe, Drilling)	3.1 Machining process requirement • Work order • Drawing • Material • Tool and equipment 3.2 Type of machine • Milling Machine • Grinding Machine • Lathe Machine • Drilling Machine 3.3 Machine parameter • Spindle Rotation speed • Cutting Feed 3.4 Machining process • Milling	3.1 Prepare machining process requirement 3.2 Select type of machine 3.3 Set machine parameter 3.4 Perform Machining process 3.5 Check machining quality	Attitude: i. Detail in examining Industrial Automation Fabrication ii. Detail in examining Industrial Automation Fabrication specifications iii. Objective focused in carrying out cutting process iv. Objective focused in carrying out machining	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	3.1 Machining process requirement selected and explained 3.2 Type of machine identified and described 3.3 Machine parameter adjusted and confirmed 3.4 Machining process applied and executed 3.5 Machining quality confirmed and presented

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Grinding • Turning • Drilling 3.5 Machining quality • Dimension • Accuracy • Sharpness • Tolerance • Surface texture		process v. Objective focused in carrying out joining process vi. Objective focused in carrying out moulding process arrangement vii. Objective focused in carrying out wiring process viii. Objective focused in carrying out printed circuit board assembling ix. Objective focused in carrying out component sub assembling <u>Safety:</u> i. Ensure data			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. Practice			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			paperless office.			
4. Perform joining process. (welding, fastener, riveting, soldering, coupling, bonding)	4.1 Prepare joining process requirement • Material specification • Hand tool • Power tool 4.2 Select type of joining machine/equipment • SMAW welding • Rivet gun • Soldering iron 4.3 Perform Joining parameter setting • Voltage • Ampere 4.4 Perform Joining process. • Butt Joint • Riveting • Soldering • Bonding 4.5 Check Joining quality. • Strength • Rigidity • Flexibility	4.1 Prepare joining process requirement 4.2 Select type of joining machine/equipment 4.3 Perform Joining parameter setting 4.4 Perform Joining process. 4.5 Check Joining quality.	<u>Attitude:</u> <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u>	<u>Related Knowledge:</u> 8 <u>Related Skills:</u> 24	<u>Related Knowledge:</u> Lecture <u>Related Skills:</u> Demonstration, Practical	4.1 joining process requirement selected and explained 4.2 Type of joining machine/equipment identified and explained 4.3 Joining parameter setting adjusted 4.4 Joining process applied 4.5 Joining quality confirmed and presented

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			i. Ensure energy saver office equipments. ii. Reduce energy wastage. Practice paperless office.			
5. Perform industrial automation fabrication product delivery preparation.	5.1 Industrial automation systems fabrication product listing • Part list • Delivery note • Part specification • Receiver detail 5.2 Industrial automation systems fabrication product tagging • Numbering system • Lettering system • Coding system	5.1 Prepare Industrial automation systems fabrication product listing 5.2 Prepare Industrial automation systems fabrication product tagging	Attitude: i. Detail in preparing Industrial Automation Fabrication & Sub Assembling product packaging requirement ii. Resourceful in obtaining Packaging procedure iii. Resourceful in obtaining	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	5.1 Industrial automation systems fabrication product listing determined and explained 5.2 Industrial automation systems fabrication product tagging applied and confirmed 5.3 Industrial automation systems fabrication product documentation completed and presented

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	5.3 Industrial automation systems fabrication product documentation • Diagram • Standard operating procedure • Manual operation 5.4 Industrial automation systems fabrication product documentation and drawing attachment method • Manual • Automatic 5.5 Industrial automation systems fabrication & sub-assembly log book • Numbering • Coding • Lettering • Person in charge • Verification • Status • Receiver	5.3 Prepare industrial automation systems fabrication product documentation 5.4 Attach industrial automation systems fabrication product documentation and drawing 5.5 Update industrial automation systems fabrication & sub-assembly log book	packaging technique iv. Resourceful in obtaining packaging safety v. Resourceful in obtaining packaging material vi. Resourceful in obtaining product packaging identification system vii. Detail in carrying out Industrial Automation Fabrication & Sub Assembling product pre-packaging inspection iii. Objective focused in carrying out Industrial Automation Fabrication &			5.4 Industrial automation systems fabrication product documentation and drawing categorized and completed 5.5 Industrial automation systems fabrication & sub-assembly log book completed and presented .

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			Sub Assembling packing process ix. Accurate in carrying out Industrial Automation Fabrication & Sub Assembling Product Labelling x. Accurate in recording Industrial Automation Fabrication & Sub Assembling product packaging <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes 01.03 Utilize basic IT applications 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/ telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read/interpret flowcharts and pictorial information 03.01 Apply cultural requirements to the workplace 03.02 Demonstrate integrity and apply ethical practices 03.03 Accept responsibility for own work and work area 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 06.01 Understand systems 06.02 Comply with and follow chain of command 06.03 Identify and highlight problems 06.04 Adapt competencies to new situations/systems 01.04 Analyse information 01.05 Utilize the Internet to locate and gather information 01.06 Utilize word processor to process information 02.06 Write memos and news 02.07 Utilize Local Area Network(LAN)/Internet to exchange information 02.08 Prepare pictorial and graphic information 03.08 Develop and maintain a cooperation within work group 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem solving strategies 04.05 Demonstrate initiative and flexibility 06.05 Analyse technical system 06.06 Monitor and correct performance of system	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

Tools, Equipment and Materials (TEM)

Items	Ratio (TEM: Trainee)
1. Power tool (Hand drill, Hand grinder, Soldering iron)	1:5
2. Hand tool	1:1
3. Disc Cutter	1:10
4. Bench Saw Machine	1:25
5. Welding Equipment	1:5
6. Fastening Equipment	1:25
7. Milling machine	1:25
8. Surface grinding machine	1:25
9. Lathe	1:25
10. Drilling machine	1:5
11. Measuring Instruments	1:5
12. Tagging Equipment	1:25

REFERENCES

1. Larry Jeffus, Delmar Cengage Learning; 1 edition (January 27, 2011), Welding and metal fabrication, ISBN-13: 978-1418013752
2. Peter Silver, William McLean, Routledge; 1 edition (March 8, 2006), Fabrication 1st Edition, ISBN: 978-0750665582
3. Richard Crowson, Assembly Processes: Finishing, Packaging, and Automation 2Ed (2006),Taylor and Francis, SBN-13: 978-0849355653
4. Hassan Abdel-Gawad El-Hofy, CRC Press; 2 edition (August 6, 2013), Fundamentals of Machining Processes: Conventional and Nonconventional Processes, Second Edition, ISBN-10: 1466577029
5. Mikell P. Groover, Wiley; 5 edition (September 24, 2012), Fundamentals of Modern Manufacturing: Materials, Processes, and Systems 5th Edition, ISBN-13: 978-1118231463
6. Michael Netzley & Graig Snow, Prentice Hall 1st. Ed. 2001, Guide to Report Writing ISBN 978-0130417718
7. John Bowden, Writing a Report- How to Accurate in preparing, Write & Present Really Effective, ISBN 978-1845284701

CURRICULUM OF COMPETENCY UNIT (CoCU)

<table>
<tr><td>SECTOR</td><td colspan="7">MACHINERY & EQUIPMENT</td></tr>
<tr><td>SUB SECTOR</td><td colspan="7">INDUSTRIAL AUTOMATION & MECHATRONIC</td></tr>
<tr><td>JOB AREA</td><td colspan="7">MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY</td></tr>
<tr><td>NOSS TITLE</td><td colspan="7">INDUSTRIAL AUTOMATION ENGINEERING SERVICES</td></tr>
<tr><td>COMPETENCY UNIT TITLE</td><td colspan="7">INDUSTRIAL AUTOMATION SUB-ASSEMBLY</td></tr>
<tr><td>PRE-REQUISITE (if appreciable)</td><td colspan="7">-</td></tr>
<tr><td>LEARNING OUTCOMES</td><td colspan="7">The outcome of this CU is to ensure automation system sub assembly work completed as per drawing specification, fully tested and function in good condition with integrate mechanically and electrically/electronically in accordance with manufacturer specification.

Upon completion of this competency unit, trainees will be able to

1. Prepare industrial automation system sub-assembly requirements
2. Perform industrial automation electrical sub assembly
3. Perform industrial automation electronic sub assembly
4. Perform industrial automation mechanical sub assembly
5. Perform industrial automation pneumatic and hydraulic sub assembly</td></tr>
<tr><td>COMPETENCY UNIT ID</td><td>MC-091-2:2016-C04</td><td>LEVEL</td><td>2</td><td>TRAINING DURATION</td><td>160 Hours</td><td>SKILLS CREDIT</td><td>16.0</td></tr>
</table>

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Prepare industrial automation system sub-assembly requirements	1.1 industrial automation system sub-assembly documentation • Work order. • Work Job step • Assembly drawing • Part Checklist • Equipment and tools list. • Confirmation sheet • Verification sheet • Job record sheet 1.2 Sub-Assembly Specifications details. • Assembly drawing. • Pneumatic/hydraulic Schematic diagram. • Electrical/electronic schematic diagram. • Industrial Automation Sub Assembling Testing record technique 1.3 Sub-Assembly tool and equipment • Type of tool • Type of equipment	1.1 Obtain industrial automation system sub-assembly documentation 1.2 Identify industrial automation system sub-assembly tool and equipment. 1.3 Obtain Sub-Assembly Specifications details. 1.4 Acquire Personnel Protection Equipment	Attitude: i. Detail in checking source of instruction ii. Detail in checking instruction authority iii. Detail in checking instruction validity iv. Detail in checking instruction content v. Confidence in accepting Industrial Automation System installation instruction vi. Accurate in recording Industrial Automation System installation instruction	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	1.1 Industrial automation system sub-assembly documentation described and selected 1.2 Industrial automation system sub-assembly tool and equipment identified 1.3 Sub-Assembly Specifications details explained. 1.4 Personnel Protection Equipment determined and selected.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	1.4 Personnel Protection Equipment Specification. • Type of PPE • PPE function • PPE application method		<u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
2 Perform industrial automation electrical sub assembly	2.1 Industrial Automation System electrical sub assembly specification. • Type of electrical schematic diagram • Symbol of electrical schematic drawing 2.2 Industrial Automation System electrical sub assembly process. • Part segregation • Part numbering • Part tagging • Part fixing • Wiring 2.3 Industrial automation system electrical part and circuit functionality checking method • Continuity • Polarity • Leakage	2.1 Prepare industrial automation system electrical sub-assembly specification. 2.2 Perform industrial automation system electrical sub assembly process 2.3 Check industrial automation system electrical part and circuit functionality 2.4 Update industrial automation Sub Assembly	Attitude: i. Focus in observing Industrial Automation System installation objective. ii. Resourceful in obtaining Industrial Automation System installation specification iii. Resourceful in obtaining Industrial Automation System installation Standard operation procedure iv. Thorough in examining prescribed installation plan	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	2.1 Industrial automation system Electrical sub- assembly specification obtained 2.2 Industrial automation system electrical sub assembly process completed and explained. 2.3 Industrial automation system electrical part and circuit functionality confirmed. 2.4 Industrial automation Sub Assembly check list completed and compiled

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	2.4 Industrial automation Sub Assembly check list • Status • Verification	check list	v. Resourceful in obtaining Industrial Automation System installation checklist vi. Resourceful in obtaining Industrial Automation System installation tools, equipment's and machineries vii. Resourceful in obtaining Industrial Automation System installation record systems. viii. Resourceful in obtaining Corrective Action Requisition Procedure. ix. Resourceful in			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			obtaining Corrective Installation Record Systems. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			equipments. ii. Reduce energy wastage. iii. Practice paperless office.			
3. Perform industrial automation electronic sub assembly	3.1 Industrial Automation System electronic sub assembly specification. • Type of electronic schematic diagram • Symbol of electronic schematic drawing 3.2 Industrial Automation System electronic sub assembly process. • component segregation • component numbering • component tagging • component fixing • Wiring 3.3 Industrial automation system electronic component and circuit	3.1 Prepare industrial automation system electronic sub- assembly specification. 3.2 Perform industrial automation system electronic sub assembly process 3.3 Check industrial automation system electronic component	Attitude: i. Thorough in examining Industrial Automation System installation specification ii. Faithful in following installation standard operating procedure. iii. Creative in applying installation implementation technique. iv. Objective focused in carrying out	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	3.1 Industrial automation system electronic sub- assembly specification obtained. 3.2 Industrial automation system electronic sub assembly process completed and explained 3.3 Industrial automation system electronic component and circuit functionality confirmed. 3.4 Industrial automation Sub Assembly check list completed and compiled.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	functionality checking method • Continuity • Polarity • Leakage 3.4 Industrial automation Sub Assembly check list • Status • Verification	and circuit functionality 3.4 Update industrial automation Sub Assembly check list	mechanical part installation program v. Objective focused in carrying out electrical part installation program vi. Objective focused in carrying out pneumatic and or hydraulic part installation Program vii. Accurate in recording Industrial Automation System installation implementation <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
4. Perform industrial automation mechanical sub assembly	4.1 Mechanical part and structure sub assembly requirement • Mechanical assembly drawing • Mechanical part specification • Operation manual 4.2 Sub assembly tools and equipment's • Hand Tool • Power Tool • Special Tool 4.3 Mechanical part and structure sub assembly process • part segregation • part sorting • part numbering • part tagging • part fixing • part lubrication 4.4 Mechanical part and structure functionality	4.1 Prepare mechanical part and structure sub assembly requirement 4.2 Obtain mechanical part and structure sub assembly tools and equipment's 4.3 Perform mechanical part and structure sub assembly process 4.4 Check mechanical part and structure functionality	Attitude: i. Resourceful in obtaining Industrial Automation System trial run instruction ii. Resourceful in obtaining Industrial Automation System trial run requirement iii. Resourceful in obtaining Industrial Automation System trial run procedure iv. Resourceful in obtaining Industrial Automation System trial run tools, equipment and machineries	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	4.1 Mechanical part and structure sub assembly requirement identified and explained. 4.2 Sub assembly tools and equipment's selected and sorted. 4.3 Mechanical part and structure sub assembly process completed and explained 4.4 Mechanical part and structure functionality confirmed and presented 4.1 Sub assembly record systems completed and compiled.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	test method • Static run • Dynamic run 4.5 Mechanical sub assembly check list • Status • Person in charge • Verification	4.5 Update sub assembly record systems	v. Objective focused in conducting mechanical performance trial run vi. Objective focused in conducting electrical functionality trial test vii. Objective focused in conducting pneumatic and hydraulic functionality test viii. Objective focused in conducting instrument functionality test ix. Objective focused in conducting Industrial Automation System trial run			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			x. Objective focused in performing Corrective Action Request Order. <u>Safety:</u> i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			workplace. <u>Environment:</u> iii. Ensure energy saver office equipments. iv. Reduce energy wastage. v. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
5. Perform industrial automation pneumatic and hydraulic sub assembly	5.1 Industrial Automation System pneumatic and hydraulic part sub assembly process • Power supply element • Input element • Processing element • Final control element • Actuator 5.2 Industrial Automation System functionality test method • Leak test • Pressure test • Movement test 5.3 Industrial Automation System trial run	5.1 Carry out industrial automation system Pneumatic and hydraulic part sub assembly process 5.2 Perform industrial automation system Functionality test design specifications. 5.3 Prepare industrial automation system trial run record specifications. 5.4 Update	Attitude: i. Timely in preparing Industrial Automation System trial run record ii. Accurate in generating Industrial Automation System trial run record iii. Confidence in submitting Industrial Automation System trial run record Safety: i. Ensure data safety. ii. Ensure safe	Related Knowledge: 8 Related Skills: 24	Related Knowledge: Lecture Related Skills: Demonstration, Practical	5.1 Industrial automation system Pneumatic and hydraulic part sub assembly process completed and explained 5.2 Industrial automation system Functionality test design specifications confirmed and presented 5.3 Industrial automation system trial run applied and documented 5.4 Industrial automation pneumatic and hydraulic sub assembly check list completed and compiled.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Manual override • Semi auto 5.4 Industrial Automation System check list • Status • Verification • Person in charge	industrial automation pneumatic and hydraulic sub assembly check list	work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. <u>Environment:</u> i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes 01.03 Utilize basic IT applications 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/ telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read/interpret flowcharts and pictorial information 03.01 Apply cultural requirements to the workplace 03.02 Demonstrate integrity and apply ethical practices 03.03 Accept responsibility for own work and work area 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 06.01 Understand systems 06.02 Comply with and follow chain of command 06.03 Identify and highlight problems 06.04 Adapt competencies to new situations/systems 01.04 Analyse information 01.05 Utilize the Internet to locate and gather information 01.06 Utilize word processor to process information 02.06 Write memos and news 02.07 Utilize Local Area Network(LAN)/Internet to exchange information 02.08 Prepare pictorial and graphic information 03.08 Develop and maintain a cooperation within work group 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem solving strategies 04.05 Demonstrate initiative and flexibility 06.05 Analyse technical system 06.06 Monitor and correct performance of system	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

Tools, Equipment and Materials (TEM)

Items	Ratio (TEM: Trainee)
1. Pneumatic Training Kit and tool 2. Hydraulic Training Kit and tool 3. Power Tool 4. Hand Tool 5. Special Tool 6. Industrial Automation Systems installation Instruction (Sample)	1:5 1:5 1.5 1:5 1.5 As required

REFERENCES

1. R. K. Rajput S. Chand, Jan 1, 2008 Robotics And Industrial Automation, ISBN: 9788121929974
2. R.K. Rajput , S. Chand, 2007, A T.B.Of Mechatronics, ISBN: 9788121928595R.
3. K. Rajput, Firewall Media, Jan 1, 2006, Basic Electrical And Electronics Engineering (PTU, Jalandhar), ISBN: 9788170081210
4. Godfrey Onwubolu, Butterworth-Heinemann, 2005, Mechatronics: Principles and Applications, ISBN: 9780080492902
5. Wayne Scraba, MotorBooks International, Practical Fabrication and Assembly Techniques, ISBN: 9781610591614
6. Jack W. Chaplin, Delmar Publishers, 1992, Instrumentation and Automation for Manufacturing: An Overview for Manufacturing Students, Supervisors, and Managers, ISBN: 9780827347137
7. Michael Netzley & Graig Snow, Prentice Hall 1st. Ed. 2001, Guide to Report Writing ISBN 978-0130417718
8. John Bowden, Writing a Report- How to Accurate in preparing, Write & Present Really Effective, ISBN 978-1845284701

CURRICULUM OF COMPETENCY UNIT (CoCU)

SECTOR	MACHINERY & EQUIPMENT						
SUB SECTOR	INDUSTRIAL AUTOMATION & MECHATRONIC						
JOB AREA	MECHATRONIC, INDUSTRIAL AUTOMATION ENGINEERING, ROBOTIC TECHNOLOGY						
NOSS TITLE	INDUSTRIAL AUTOMATION ENGINEERING SERVICES						
COMPETENCY UNIT TITLE	INDUSTRIAL AUTOMATION SYSTEM SERVICING						
PRE-REQUISITE (if appreciable)	-						
LEARNING OUTCOMES	The outcome of this CU is to ensure the industrial automation servicing perform well during breakdowns, reduce operation idle time and minimize the stoppage interferences records which optimize overall maintenance cost. The technician is also responsible to achieve his individual and team performance objectives and contribute toward the highest achievement of the operation in accordance with the organization requirements. Upon completion of this competency unit, trainees will be able to: 1. Perform Of Industrial Automation System servicing Instruction and Requirements 2. Perform industrial automation system mechanical servicing 3. Perform industrial automation system Electrical servicing 4. Perform industrial automation system Electronic servicing 5. Perform industrial automation system Pneumatic and Hydraulic servicing						
COMPETENCY UNIT ID	MC-091-2:2016-C05	**LEVEL**	2	**TRAINING DURATION**	160 Hours	**SKILLS CREDIT**	16.0

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
1. Perform Of Industrial Automation System Servicing Instruction and Requirements	1.1 Industrial automation system servicing specification method 1.2 Industrial automation system servicing standard operation procedure method 1.3 Corrective service standard operating procedure method 1.4 Service action requisition procedure method 1.5 Corrective action frequency method	1.1 Obtain Industrial automation system servicing specification 1.2 Obtain Industrial automation system servicing standard operation procedure 1.3 Collect Corrective service standard operating procedure. 1.4 Obtain Service action requisition procedure 1.5 Obtain Corrective	*Attitude:* i. Factual in checking source of instruction ii. Factual in checking instruction authority iii. Factual in checking instruction validity iv. Detailed in checking instruction content v. Confidence in accepting industrial automation system maintenance instruction vi. Accurate in recording industrial automation system maintenance instruction	Related Knowledge 6 Related Skills: 24	Related Knowledge Lecture. Related Skills: Observation, Demonstration and Practical	1.1 Industrial automation system servicing specification identified and explained 1.2 Industrial automation system servicing standard operation procedure identified and explained 1.3 Corrective service standard operating procedure identified and explained 1.4 Service action requisition procedure identified and explained 1.5 Corrective action frequency identified and explained

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
		action frequency.	*Safety:* i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. *Environment:* i. Ensure energy saver office equipments. ii. Reduce			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			energy wastage. Practice paperless office.			
2. Perform industrial automation system mechanical servicing	2.1. Corrective action requisition. • Fault description • Person in charge • Type of requisition form. 2.2. Type of Tools and equipment • Hand tool • Power tool • Spirit level tool 2.3. Routine maintenance servicing method • oil level • belt tension • grease oil • schedule	2.1. Interpret Corrective action requisition 2.2. Prepare tools and equipment 2.3. Perform Routine maintenance 2.4. Identify faulty parts / components . 2.5. Dismantle Faulty parts / components. 2.6. Replace faulty part / components. 2.7. Conduct	*Attitude:* i. Focus in observing Industrial Automation System maintenance objective. ii. Resourceful in obtaining Industrial Automation System maintenance specification iii. Resourceful in obtaining Industrial Automation System maintenance Standard operation procedure iv. Thorough in	Related Knowledge 7 Related Skills 24	Related Knowledge Lecture Related Skills Observation, Demonstration and Practical	2.1. Corrective action requisition identified and explained 2.2. tools and equipment identified and explained 2.3. Routine maintenance applied 2.4. Identify faulty parts / components determined and explained 2.5. Faulty parts / components determined and explained 2.6. faulty part / components identified and changed

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	2.4. Type of faulty parts / components. • Excessive vibration • Static unbalance • Dynamic unbalance • Wear and tear • Manufacturing defect 2.5. Faulty components dismantling method • First In First Out • Last in Last out • Tag in Tag out 2.6. Faulty components replacement method • Robust component • Flexible component	Mechanical test. 2.8. Update Log book.	examining prescribed Industrial Automation System Total Preventive Maintenance (TPM) plan v. Resourceful in obtaining Industrial Automation System TPM wear and tear spare part list vi. Resourceful in obtaining Industrial Automation System TPM Check list vii. Resourceful in obtaining Industrial Automation System TPM maintenance tools, equipments and machineries iii. Resourceful in			2.7. Mechanical test conducted 2.8. Industrial Automation System Mechanical servicing Log book completed.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Consumable component 2.7. Type of Mechanical test. • Dynamic balancing test • Static balancing test • Strength test • Hardness test 2.8. Industrial automation system mechanical servicing Log book. • Format • Filing		obtaining Industrial Automation TPM record systems. ix. Resourceful in gathering Corrective Maintenance Standard Operating Procedure x. Resourceful in obtaining Corrective Action Requisition Procedure. xi. Resourceful in obtaining Corrective Action frequency analysis. xii. Resourceful in obtaining Corrective Maintenance Record Systems. *Safety:*			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. *Environment:* i. Ensure energy saver office equipments. ii. Reduce energy wastage.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			Practice paperless office.			
3. Perform Industrial Automation System Electrical servicing	3.1 Corrective action requisition • Fault description • Person in charge • Type of requisition form. 3.2 Type of Electrical tools and equipment. • Hand tool • Power tool • Measurement tool 3.3 Industrial automation system electrical servicing method. • Cleaning • Setting • Adjusting . 3.4 Type of Faulty parts / components • Short circuit • Burn	3.1 Interpret Corrective action requisition 3.2 Prepare tools and equipment. 3.3 Perform industrial automation system electrical servicing method. 3.4 Recognise Faulty parts / components 3.5 Dismantle faulty component 3.6 Replace Faulty parts / components	*Attitude:* i. Thorough in examining Industrial Automation System service specification ii. Faithful in following TPM standard operating procedure. iii. Creative in applying TPM implementation technique. iv. Objective focused in carrying out electrical part TPM program v. Thorough in carrying out electrical part TPM program vi. Objective focused in carrying	Related Knowledge **9** Related Skills 24	Related Knowledge Lecture Related Skills Observation, Demonstration and Practical	3.1 Corrective action requisition identified and explained. 3.2 Tools and equipment identified and explained. 3.3 Industrial automation system electrical servicing method applied. 3.4 Faulty parts / components determined and explained 3.5 Faulty parts / components dismantling method determined and explained 3.6 Faulty parts / components identified and changed.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Intermittent • Overcurrent 3.5 Part dismantling method • First In First Out • Last in Last out • Tag in Tag out 3.6 Faulty parts / components replacement method • Rewiring • Tightening • Solder and de-soldering • Fastening . 3.7 Functionality test method • Continuity test • Function test • Polarity test 3.8 Industrial automation system electrical servicing Log book. • Format • Filing	. 3.7 Conduct functionality test. 3.8 Update Log book.	electrical part TPM Program vii. Objective focused in carrying electrical TPM Program iii. Thorough in performing Corrective Action Request Order. ix. Accurate in recording Industrial Automation System electrical maintenance implementation *Safety:* i. Ensure data safety. ii. Ensure safe work methodology. iii. Ensure electrical			3.7 Functionality test executed. 3.8 Industrial Automation System Electrical servicing Log book completed.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
			safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. *Environment:* i. Ensure energy saver office equipments. ii. Reduce energy wastage. iii. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
4. Perform Industrial Automation System Electronic Servicing	4.1. Corrective action requisition • Fault description • Person in charge • Type of requisition form. 4.2. Type of Electronics tools and equipment • Hand tool • Measurement tool 4.3. Industrial automation system electronic servicing method. • Checking • Cleaning • Setting • Adjusting • Calibrating . 4.4. Type of Faulty parts / components • Short circuit • Burn • Intermittent	4.1. Interpret Corrective action requisition 4.2. Prepare tools and equipment 4.3. Perform industrial automation system electronic servicing method. 4.4. Recognise Faulty electronic components/ Printed Circuit Board 4.5. Dismantle part/compone nt. 4.6. Replace Faulty Printed Circuit Board / Electronic	*Attitude:* i. Thorough in examining Industrial Automation System service specification ii. Faithful in following TPM standard operating procedure. iii. Creative in applying TPM implementatio n technique. iv. Objective focused in carrying out mechanical part TPM program v. Thorough in carrying out electrical part TPM program vi. Objective focused in carrying pneumatic /	Related Knowledge 9 Related Skills 24	Related Knowledge Lecture Related Skills Observation, Demonstration and Practical	4.1. Corrective action requisition identified and explained. 4.2. Tools and equipment identified and explained. 4.3. Industrial automation system electronic servicing method applied. 4.4. Faulty parts / components determined and explained 4.5. Dismantle part/component method determined and explained 4.6. Faulty parts / components identified and changed. . 4.7. Functionality test executed. 4.8. Industrial Automation

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	• Overcurrent • Manufacturing defect • Component defect 4.5. Part dismantling method • First In First Out • Last in Last out • Tag in Tag out 4.6. Faulty Printed Circuit Board / electronic components replacement method • Snap fitting • Fastening • Solder and de-soldering . 4.7. Functionality test method • Continuity test • Function test • Polarity test 4.8. Industrial automation system electrical	components 4.7. Conduct functionality test. 4.8. Update Log book	hydraulic part TPM Program vii. Objective focused in carrying instrument TPM Program iii. Thorough in performing Corrective Action Request Order. ix. Accurate in recording Industrial Automation System maintenance implementation *Safety:* vii. Ensure data safety. viii. Ensure safe work methodology. ix. Ensure electrical safety on all electrically			System Electronic servicing Log book completed.

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	servicing Log book. • Format • Filing		powered equipment. x. Enforce safety & health rules and regulations xi. Ensure safe working condition. xii. Promote good safety & health practice at workplace. *Environment:* iv. Ensure energy saver office equipments. v. Reduce energy wastage. Practice paperless office.			

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
5. Perform industrial automation system Pneumatic and Hydraulic servicing.	5.1 Routine maintenance Type • air and oil leakage, • oil level, • tubing and connecting 5.2 Corrective action requisition description • Fault description • Person in charge • Type of requisition form. 5.3 Type of Tools and facilities • Hand tool • Power Tool • Measurement tool 5.4 Type of Faulty parts / components • Wear and tear • Manufacturing defect • Malfunction	5.1 Performed Routine maintenance • air and oil leakage, • oil level, • tubing and connectin g 5.2 Respond to Corrective action requisition 5.3 Prepare Tools and facilities 5.4 Recognise Faulty parts / components 5.5 Dismantle Faulty parts / components dismantled. 5.6 Replace Faulty part / components	*Attitude:* i. Meticulous in conducting mechanical test ii. Meticulous in conducting electrical test iii. Meticulous in conducting pneumatic and hydraulic test iv. Meticulous in conducting instrument test v. Systematic in compiling Industrial Automation System maintenance periodical systems test result. *Safety:* i. Ensure data safety. ii. Ensure safe	Related Knowledge 9 Related Skills 24	Related Knowledge Lecture Related Skills Observation, Demonstration and Practical	5.1 Routine maintenance identified and explained 5.2 Corrective action requisition determined and explained 5.3 Tools and facilities identified and explained 5.4 Faulty parts / components identified and explained 5.5 Faulty parts / components identified and explained 5.6 Faulty parts / components replacement method applied and executed 5.7 Functionality test conducted 5.8 industrial automation system Pneumatic and Hydraulic

Work Activities	Related Knowledge	Related Skills	Attitude/Safety/ Environmental	Training Hours	Delivery Mode	Assessment Criteria
	5.5 Faulty parts / components dismantling method. • First In First Out • Last in Last out • Tag in Tag out 5.6 Faulty part / components replacement method • Snap fitting • Fastening 5.7 Functionality test method. • Sequence test • Force requirement 5.8 industrial automation system Pneumatic and Hydraulic servicing Log book updating	5.7 Conduct Functionality test 5.8 Update industrial automation system Pneumatic and Hydraulic servicing Log book	work methodology. iii. Ensure electrical safety on all electrically powered equipment. iv. Enforce safety & health rules and regulations v. Ensure safe working condition. vi. Promote good safety & health practice at workplace. *Environment:* i. Ensure energy saver office equipments. ii. Reduce energy wastage. Practice paperless office.			servicing Log book updated

Employability Skills

Core Abilities	Social Skills
01.01 Identify and gather information 01.02 Document information, procedures or processes 01.03 Utilize basic IT applications 02.01 Interpret and follow manuals, instructions and SOP's 02.02 Follow telephone/ telecommunication procedures 02.03 Communicate clearly 02.04 Prepare brief reports and checklists using standard forms 02.05 Read/interpret flowcharts and pictorial information 03.01 Apply cultural requirements to the workplace 03.02 Demonstrate integrity and apply ethical practices 03.03 Accept responsibility for own work and work area 03.04 Seek and act constructively upon feedback about performance 03.05 Demonstrate safety skills 03.06 Respond appropriately to people and situations 03.07 Resolve interpersonal conflicts 06.01 Understand systems 06.02 Comply with and follow chain of command 06.03 Identify and highlight problems 06.04 Adapt competencies to new situations/systems 01.04 Analyse information 01.05 Utilize the Internet to locate and gather information 01.06 Utilize word processor to process information 02.06 Write memos and news 02.07 Utilize Local Area Network(LAN)/Internet to exchange information 02.08 Prepare pictorial and graphic information 03.08 Develop and maintain a cooperation within work group 04.01 Organize own work activities 04.02 Set and revise own objectives and goals 04.03 Organize and maintain own workplace 04.04 Apply problem solving strategies 04.05 Demonstrate initiative and flexibility 06.05 Analyse technical system 06.06 Monitor and correct performance of system	1. Communication skills 2. Conceptual skills 3. Interpersonal skills 4. Learning skills 5. Leadership skills 6. Multitasking and prioritizing 7. Self-discipline 8. Teamwork

Tools, Equipment and Materials (TEM)

Items	Ratio (TEM: Trainee)
1. LCD Projector or other type of projector with white screen. 2. Computer Set with words processing. 3. Individual maintenance Tools Set. 4. Pneumatic Training Kit set and tool 5. Hydraulic Training Kit set and tool. 6. Electrical/ Electronic Repair Kit and Tool. 7. Personal Safety Attire	1:25 1:25 1:1 1:5 1:5 1:5 1:1

REFERENCES

1. Michael Brumbach, Cengage Learning, 2003, Industrial Maintenance, ISBN: 9781133416296
2. Seiichi Nakajima, Productivity Pr; 11th.Ed. (1988), Introduction to TPM: Total Productive Maintenance (Preventative Maintenance Series), ISBN: 978-0915299232
3. Terry Wireman , Reliabilityweb.com Press; 1st Ed. (2011)Maintenance Strategy Series Volume 3 - Maintenance Work Management Processes, ISBN: 978-0983225867
4. Richard Palmer , Palmer & Doc Palmer, McGraw-Hill Professional Publishing; 3 Ed. (2012), Maintenance Planning and Scheduling Handbook 3/E, ISBN: 978-0071784115
5. Joel Levitt, Industrial Press, Inc.; 2 Ed.(2009), Handbook of Maintenance Management, ISBN: 978-0831133894
6. Terry L.M. Bartelt, Cengage Learning; 1 Ed., 2010, Industrial Automated Systems: Instrumentation and Motion Control, ISBN: 978-1435488885
7. Frank Lamb, McGraw-Hill Professional; 1 edition,2013, Industrial Automation: Hands On, ISBN: 978-0071816458
8. Andrew Parr, Butterworth-Heinemann; 3 edition 2011, Hydraulics and Pneumatics, Third Edition: A technician's and engineer's guide, ISBN: 978-0080966748
9. R. K. Rajput S. Chand, Jan 1, 2008 Robotics And Industrial Automation, ISBN: 9788121929974
10. R.K. Rajput , S. Chand, 2007, A T.B.Of Mechatronics, ISBN: 9788121928595R.
11. K. Rajput, Firewall Media, Jan 1, 2006, Basic Electrical And Electronics Engineering (PTU, Jalandhar), ISBN: 9788170081210

12. Godfrey Onwubolu, Butterworth-Heinemann, 2005, Mechatronics: Principles and Applications, ISBN: 9780080492902
13. Jack W. Chaplin, Delmar Publishers, 1992, Instrumentation and Automation for Manufacturing: An Overview for Manufacturing Students, Supervisors, and Managers, ISBN: 9780827347137
14. Dale R. Patrick, Stephen W. Fardo, The Fairmont Press, Inc., 2009, Industrial Process Control Systems, ISBN: 9780881735925
15. Michael Netzley & Graig Snow, Prentice Hall 1st. Ed. 2001, Guide to Report Writing ISBN 978-0130417718
16. John Bowden, Writing a Report- How to Accurate in preparing, Write & Present Really Effective, ISBN 978-1845284701

SUMMARY OF TRAINING DURATION FOR INDUSTRIAL AUTOMATION ENGINEERING SERVICES (LEVEL 2)

NO. ID	COMPETENCY UNIT TITLE	WORK ACTIVITIES	RELATED KNOWLEDGE (A)	RELATED SKILLS (B)	HOURS (A) + (B)	TOTAL (HRS)
MC-091-2:2015-C01	INDUSTRIAL AUTOMATION ENGINEERING DRAWING	1. Perform Industrial Automation Engineering Sketching	3	7	10	**160**
		2. Perform two dimensional Industrial automation engineering drawing development	15	28	43	
		3. Perform three dimensional Industrial Automation engineering drawing development	18	42	60	
		4. Prepare Industrial Automation Drawing Bill of Materials	9	21	30	
		5. Perform Industrial Automation Engineering Drawing Filing	3	14	17	
MC-091-2:2015-C02	INDUSTRIAL AUTOMATION FUNDAMENTAL CONTROL PROGRAMMING	1. Prepare Industrial Automation Control Systems software setup requirements	6	14	20	**160**
		2. Prepare Industrial Automation Control Systems hardware setup requirements	6	14	20	
		3. Review Characteristics of Industrial Automation Control System	6	14	20	
		4. Perform Industrial Automation Control Systems Programming	18	42	60	
		5. Testing and Debugging	9	21	30	
		6. Perform industrial automation product delivery preparation	3	7	10	
MC-091-2:2015-C03	INDUSTRIAL AUTOMATION FABRICATION	1. Perform Industrial Automation Fabrication Requirement	8	24	32	**160**
		2. Perform cutting process. (Power Saw, Bench Saw, Punching)	8	24	32	
		3. Perform machining process. (Milling, surface grinding, Lathe, Drilling, CNC)	8	24	32	
		4. Perform joining process. (welding, fastener, riveting, soldering, coupling, bonding)	8	24	32	
		5. Perform industrial automation fabrication product delivery preparation.	8	24	32	
MC-091-2:2015-C04	INDUSTRIAL AUTOMATION SUB - ASSEMBLY	1. Prepare industrial automation system Sub - Assembly requirements	8	24	32	**160**
		2. Perform Industrial Automation Electrical Installation	8	24	32	
		3. Perform Industrial Automation Electronic installation	8	24	32	
		4. Perform Industrial Automation mechanical part and structure installation	8	24	32	
		5. Perform Industrial Automation pneumatic and hydraulic installation	8	24	32	
MC-091-2:2015-C05	INDUSTRIAL AUTOMATION SYSTEMS SERVICING	1. Perform Industrial Automation Systems Servicing Requirements	6	24	30	**160**
		2. Perform industrial automation system mechanical servicing	7	24	31	
		3. Perform industrial automation system Electrical servicing	9	24	33	
		4. Perform industrial automation system Electronic servicing	9	24	33	
		5. Perform industrial automation system Pneumatic and Hydraulic servicing.	9	24	33	
		TOTAL HOURS (Core Competencies)	216	584	800	**800**