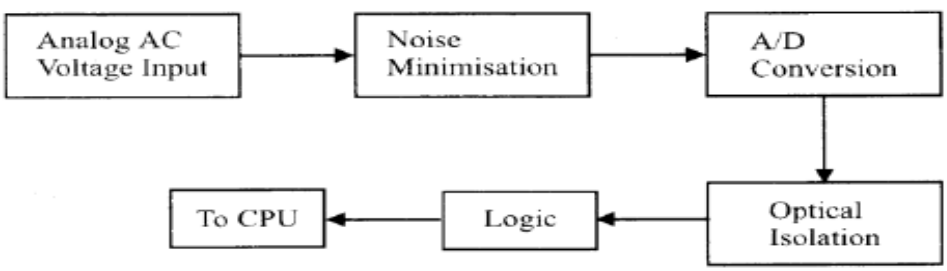
MODEL ANSWER

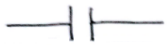
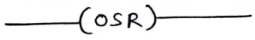
WINTER– 17 EXAMINATION

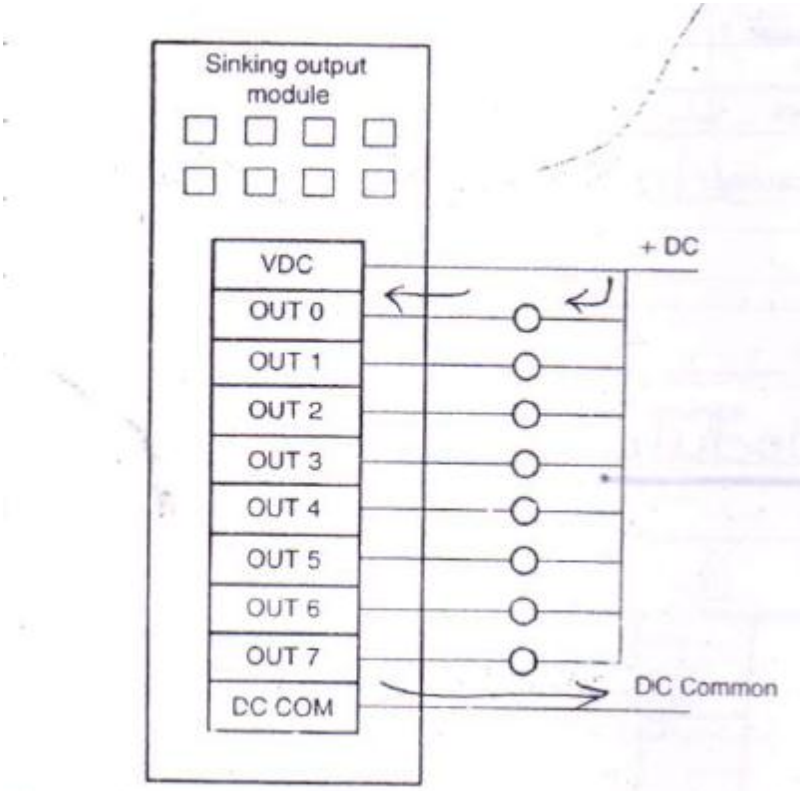
Subject Title: Industrial Automation **Subject Code:** 17664

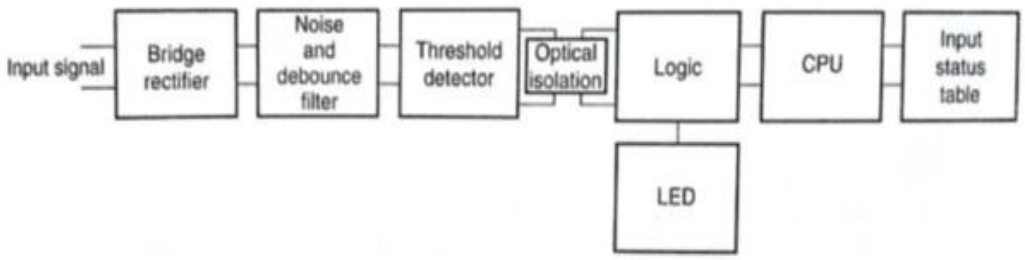
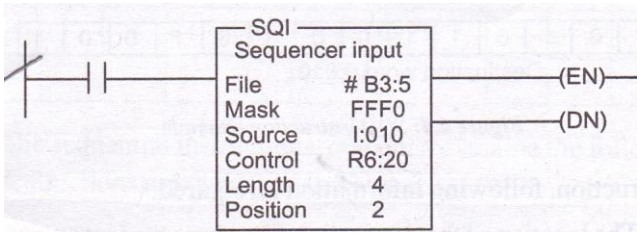
Important Instructions to examiners:

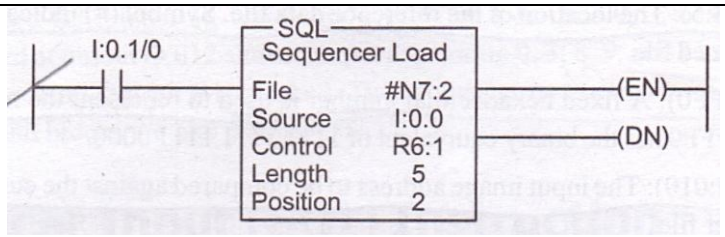
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1	**(A)**	**Attempt any THREE:**	**12-Total Marks**
	a)	**State the need of Automation.**	**4M**
	Ans:	**Need of Automation in process : (Any FOUR points)** • To fulfill the demand of product at right time. • To reduce the human errors and involvement of human being in the process. • For better productivity. • For better control of process. • For better quality. • For reducing man power. • For reducing cost of product. ***Note : Any other relevant points should be considered***	**1M for each point**
	b)	**Draw the block diagram of Analog input module.**	**4M**
	Ans:	**Block diagram of Analog input module=** 	**2M**

		Description- Analog input module interface a PLC to analog input signals. It gives ability to PLC to monitor a continuously changing input signals such as pressure, temperature, flow etc. The module converts analog input signals to 16 bit binary values storage in the processor's input status table. Analog modules are designed to accept current and voltage signals such as 0-10 Vdc,-10-10 Vdc, 0-5Vdc and 0-20mA,4-20mA,- 20 - 20mA etc. When signal reaches an input module, it is rich in different noise signals. **Noise minimization**:-The signal is freed from noise through noise minimization circuits. The signal is then digitized and sent to logic section through an isolation circuit. **A/D Conversion**:- It convert analog to digital signal required for further process. **Optical Isolation**: It is used to protect CPU from high voltage coming from fault in the input section. **Logic section**:-The logic section allows the digitized signal to go to the CPU following the predetermined logic	**2M**
	c)	**Draw the symbols of following instruction in ladder logic:** **(i) NO** **(ii) OSR** **(iii) Output coil** **(iv) NC**	**4M**
	Ans:	1**. Normally open or examine if ON (N/O)** **Symbol:**  2.**One shot rising (OSR)** **Symbol:**  **(iii)Output coil**  4. **Normally closed or examine if OFF (N/C)** **Symbol:** 	**1M each symbol**
	d)	**Illustrate the concept of sinking type of DC output module.**	**4M**
	Ans:	**Diagram:**	**3M**

		 Sinking output module interface to field device. This diagram is of sinking o/p module current first flows through field device hence field device acts as source device output module acts as sinking because current flows to ground through module.	**1M**
	B)	**Attempt any ONE :**	**6M**
	a)	**State the two advantages of PLC over relay logic. (any six)**	**6M**
	Ans:	**<u>Advantages of PLC over relay logic: (Any SIX)</u>** 1. PLC are more flexible than relay logic circuit 2. PLC offer easy troubleshooting and correcting any errors. 3. PLC are designed for high speed and real time applications. 4. Power required for PLC is less than relay control logic. 5. PLC is more reliable than relay and life is more than relay. 6. PLC system has less downtime than relay logic. 7. Internal memory available in PLC system and not in relay logic. 8. PLC system are quickly reprogrammable over relay logic. 9. Maintenance cost of PLC is less than relay logic.	**1M Each**
	b)	**Draw the block diagram of AC input module. State the function of each.**	**6M**
	Ans:	**<u>Block diagram of AC input module:</u>**	**3M**

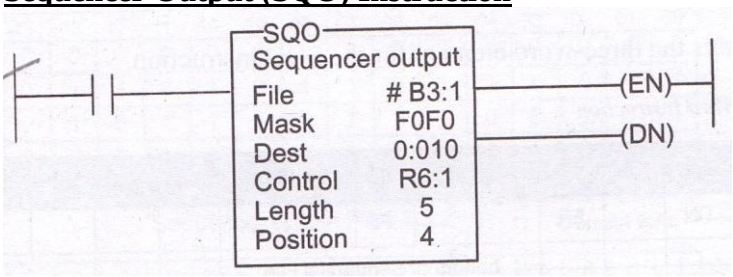
		 **Explanation:** **Power conversion:**The power conversion section usually consists of resistors and bridge rectifier. The bridge rectifier converts the incoming AC signal to a pulsating DC level. The DC level is passed through filters and other logic circuits in order to deliver a clean, denounced, DC input signal. The filtered DC signal goes on to the threshold detector. **Threshold detection:**Threshold detection circuitry detects if the incoming signal has reached or exceeded a predetermined value for a predetermine time, and whether it should be classified as valid ON or OFF signal. **Isolation:**Isolation section of the input ckt. Is usually made up of an optical isolator, or opt coupler. In a 120VAC input module, isolation separates the high voltage, 120VAC input signal from the CPUs low voltage control logic. **Logic section:**DC signal from the opto coupler are used by the logic section to pass the input signal to the module's input address LED and the CPU and then on to the input status file.	**3M**
Q 2		**Attempt any two:**	**16M**
	(a)	**Draw and explain the format of sequencer instruction and scale with Parameter instruction of PLC.**	**8M**
	Ans:	**Format of SQI instruction-**  File (#B3:5): The location of the reference data file. Symbol (#) indicates that this is a user-defined file. Mask (FFFO): A fixed hexadecimal number is used to represent the mask word. Source (1:010): The input image address to be compared against the current step of the sequencer file. Control (R6:20): The control structure that controls the operation. Length (4) The number of words. Position (2): The current step or position. **OR** **Sequencer Load (SQL) Instruction-**	**Any one sequencer instruction:4M**



File (#N7~2): The location of the destination file where the instruction would be written symbol (#) indicates this file is a user-defined file.
Source (1:0.0): The input image word address. The source word address is input word 0 in slot 0. Control (R6: 1): The control structure that controls the operation.
Length (5): The number of words.
Position (2): The current step.

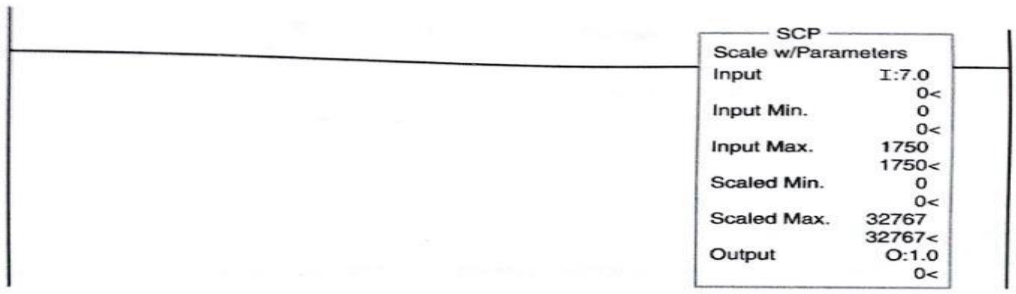
OR

Sequencer Output (SQO) Instruction



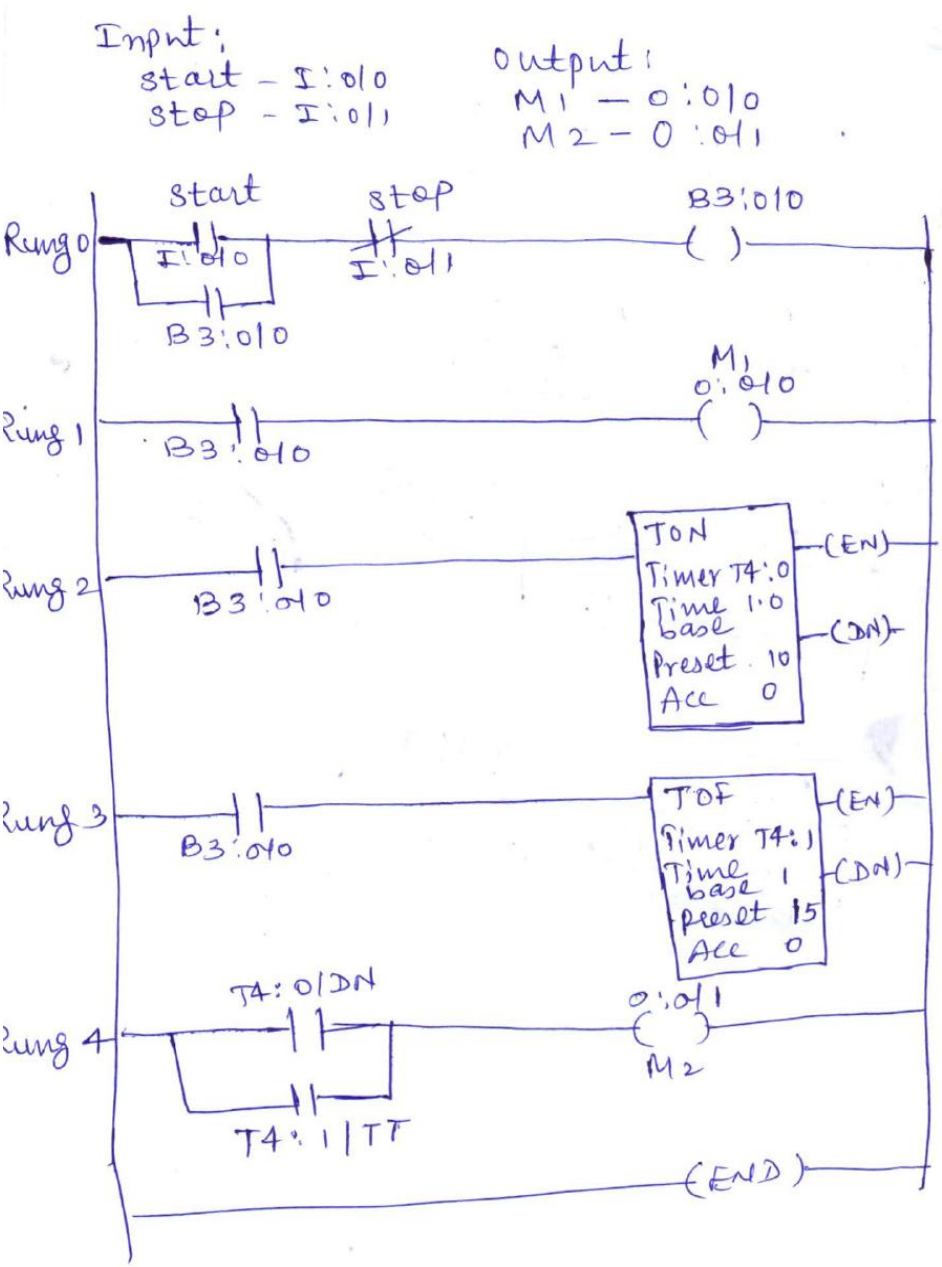
File is the address of the sequencer file # is the file indicator symbol.
Mask is the address of mask word or file through which all sequencer file data passes and goes to destination word.
Destination is the address of the output word position.
Control is the address of the control structure in the control area(R)of the data file.
Length is the number of steps of the sequencer file, which starts at position 1.
Position is the step, or word location, where the sequencer file is positioned presently.

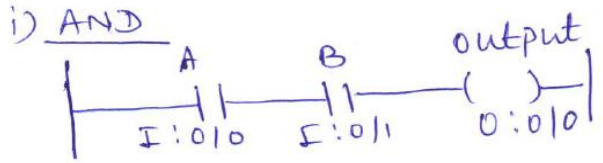
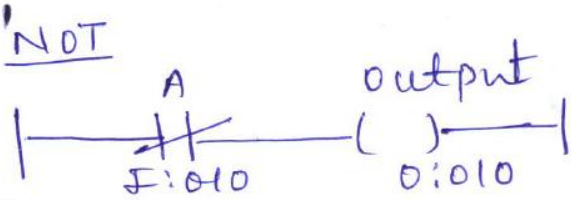
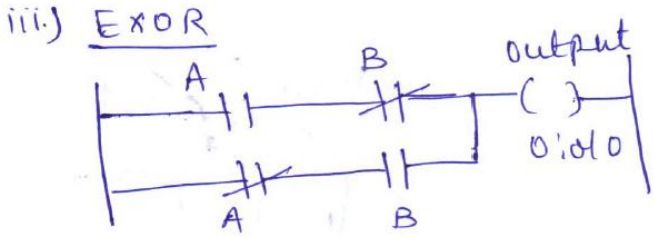
Format of SCP instruction: **4M**

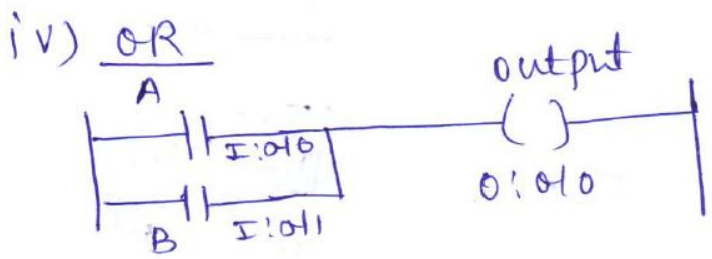


The scale with parameters instruction scaling the input value of 0 to 1750 to 0 to 32767.

Explanation:
The instruction parameters shown in above fig are explained as follows:
Input: This is the input value to be scaled. It can be address, integer or floating point address.

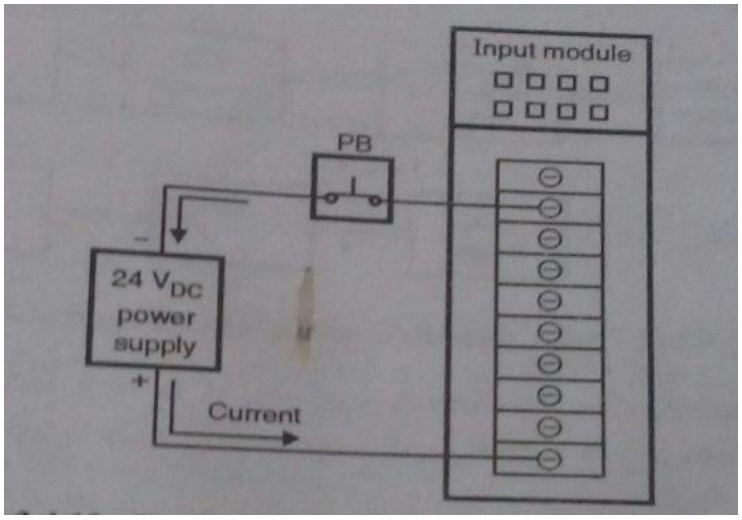
		Input min: the input minimum is the minimum input value. **Input max:** Input maximum is the maximum input value. **Scaled min:** This represents the input scaled minimum value. **Scaled max:** scaled maximum is the scaled or converted maximum value. **Output:** Enter the address for the scaled input data to be output after instruction execution. This can be an address, integer or floating point address	
	(b)	**Draw the ladder diagram for following conditions :** **(i) When start switch pressed, motor 1 starts after 10 sec motor 2 starts** **(ii) When stop switch pressed, motor 1 stops, 15 sec later motor 2 stops.**	**8M**
	Ans:	 ***Note : Any other relevant LOGIC should be considered***	**Ladder diagram:6M** **Note:** **Full marks should be given to correct logic**

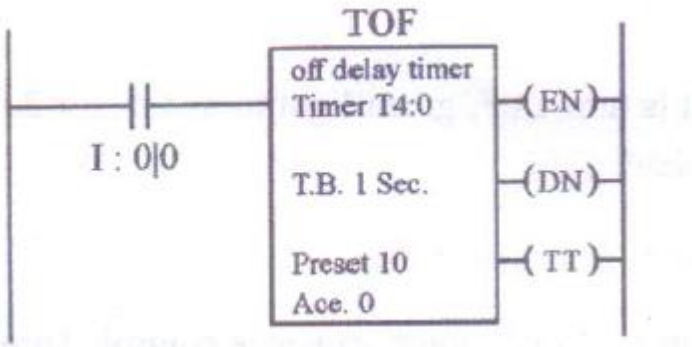
	(c)	**Draw the ladder diagram to verify the truth table of following logic gates.** **(i) AND** **(ii) NOT** **(iii) EXOR** **(iv) OR**	**8M**
	Ans:	 **Source A / Source B / Destination** 0 0 0 1 0 0 0 1 0 1 1 1  **Source / Destination** 0 1 1 0  **Inputs A B / Output Y** 0 0 0 0 1 1 1 0 1 1 1 0 XOR truth table	**Each ladder diagram:2M**

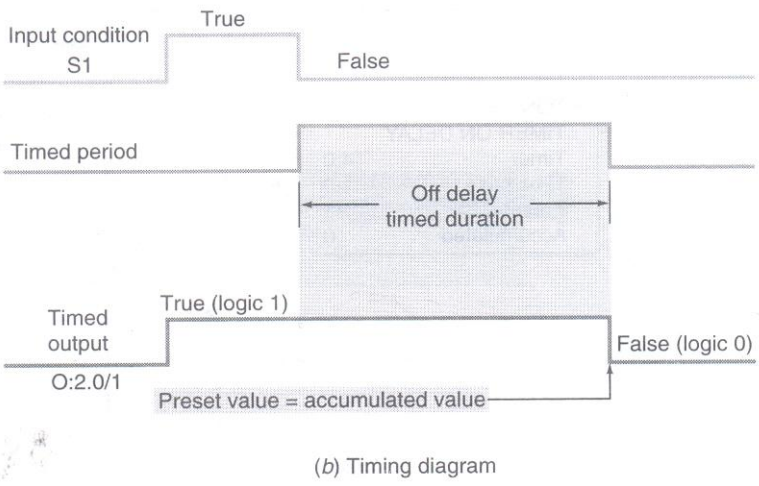
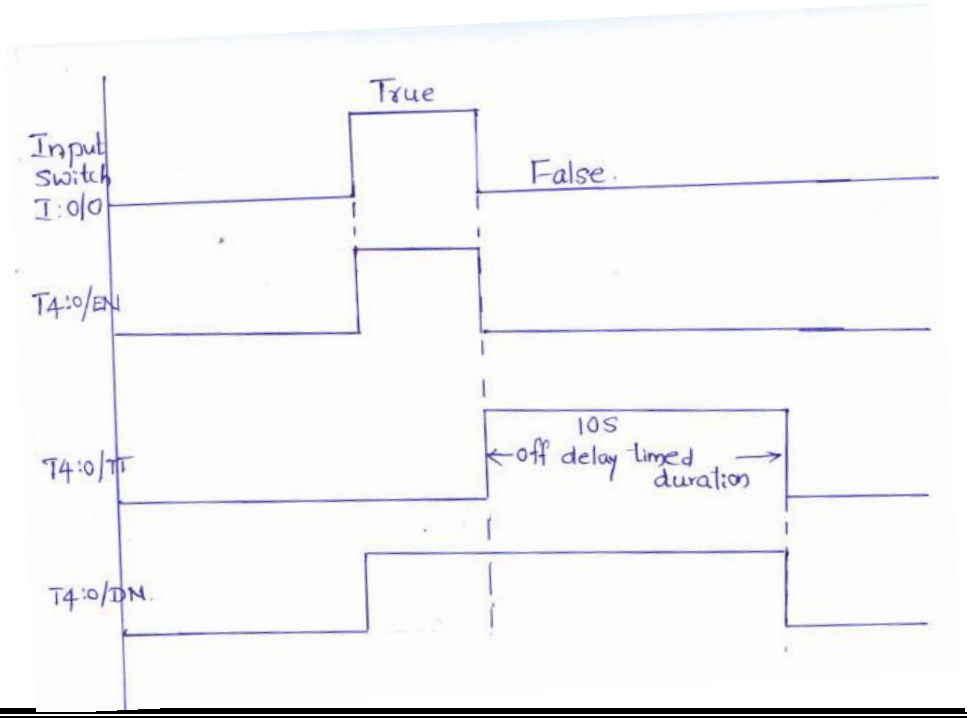


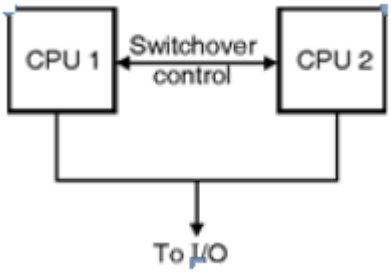
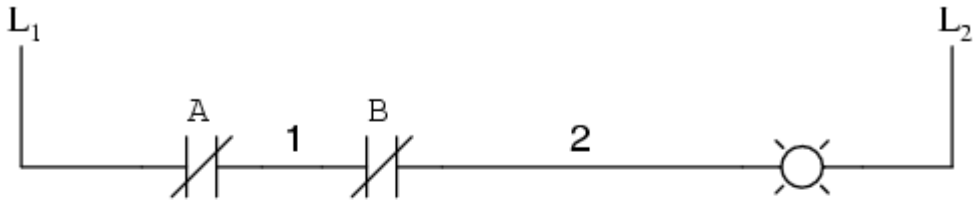
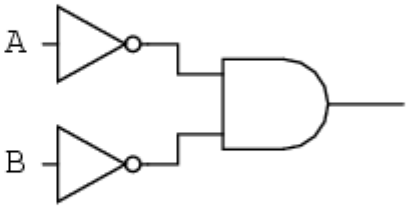
Source A	Source B	Destination
0	0	0
1	0	1
0	1	1
1	1	1

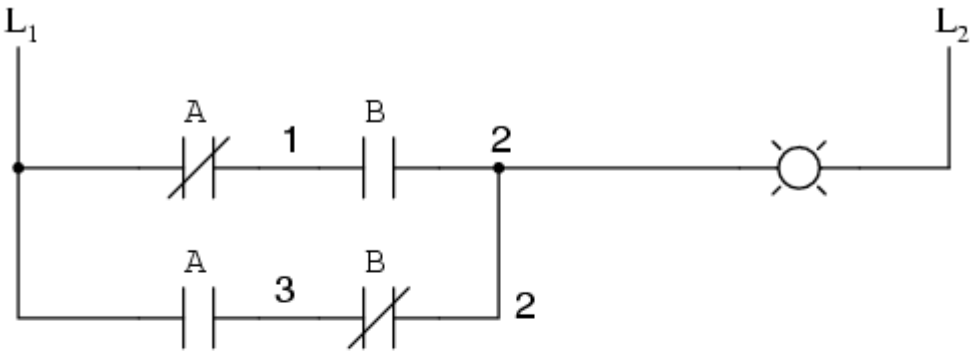
Q. 3		**Attempt any four:**	**16M**
	a)	**Give the functions of following components ofPLC :** **(i) l/P modules** **(ii) CPU**	**4M**
	Ans:	**(i) <u>l/P modules</u>** • Verify the input as valid signal from field device • Isolate the high-voltage field device signal from the lower – voltage CPU signal • Send the appropriate ON or OFF signal to the CPU for placement in the input status file **(ii) <u>CPU:</u>** It performs arithmetic and logic functions It decodes and executes instructions It executes operating system, manages memory, monitors inputs, It evaluates the user logic, turns on the appropriate outputs, It handles communication and interactions with other components	**2M each**
	b)	**Enlist benefits of Automation. (any four)**	**4M**
	Ans:	**<u>Benefits of Automation:</u>** 1)Increases productivity 2) Increases product quality 3)Increases flexibility and convertibility 4) Reduces manpower 5)Reduction of personal accident 6) Reduces cost of product 7) Better inventory control 8) Increases profit ***<u>Note : Any other relevant points should be considered</u>*** **.**	**1M for each benefit.(Any four)**
	c)	**Draw the diagram sourcing input module and explain.**	**4M**

	Ans:	**<u>Explaination-</u>**The interface diagram of PLC input module as sourcing is shown in figure. In operation, PLC input module as sourcing, current from power supply first flows from input module to load and then to common terminal so the input module acts as source of current. **<u>Diagram-</u>**  **Fig. Sourcing input module**	**2M** **2M**
	d)	**If input addressing ofPLC is I 1 : 2.0/3. What does 1, 1,2,0,3 indicates?**	**4M**
	Ans:	I – Input 1 – Input file number : – File Separator 2 – RACK NO. 2 0 – SLOT NO. 0 3 – 3rd input terminal	**1M each**
	e)	**State four precautions when placing PLC in an enclosure.**	**4M**
	Ans:	**Precautions when placing PLC in an enclosure.(Any four)** 1) Allow maximum convection cooling, all controller components should be mounted vertically, in some cases components mounted horizontally will obstruct air flow 2)The power supply has a higher heat dissipation, so power supply should be installed at the top of the enclosure above all other equipment, with adequate spacing between power supply and the top of the enclosure 3) The CPU should be located at a comfortable working level that is either to or below the power supply. If the CPU and power supply are contained in a single PLC unit, then the PLC unit should be placed toward the top of the enclosure with no other components directly above it, unless there is sufficient space 4) Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 150mm or more between them.	**1M each**

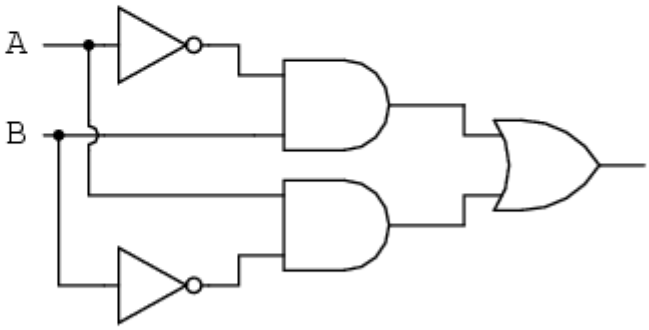
		Failure to do so may result in malfunction due to noise 5) At power-on or power-off, a voltage or current may flow between output terminals momentarily. In this case, start the control after analog outputs become stable. ***Note: Any other relevant precaution***	
Q. 4	**A)**	**Attempt any THREE:**	**12M**
	(a)	**Draw the timing diagram for following timer instruction bit:** (i) I : 0|0 (ii) EN (iii) DN (iv) TT 	**4M**

	Ans:	 (*b*) Timing diagram **OR** 	**1M Each**
	(b)	**State the concept of redundancy w.r.t. PLC.**	**4M**
	Ans:	**Redundancy :** • Redundancy means extra system components or mechanisms added to decrease the chance of total system failure. • Different types of redundancy are available in PLC like redundancy for a CPU module, power module, bases and communication module is available. • CPU redundancy system is composed of separate bases for ideal redundancy structure. • In case an error occurs in an active CPU module, a backup module is	**4M**

		automatically converted to active one for continuous operation. • In these cases two processors can be tied into one I/O system and some means is provided that switches control from the failure CPU to the backup when a failure CPU to the backup when a failure occurs as shown in Fig.  	
	(c)	**Draw ladder diagram for given truth tables:** A B y: 0 0 1; 0 1 0; 1 0 0; 1 1 0 A B y: 0 0 1; 0 1 0; 1 0 0; 1 1 1	**4M**
	Ans:	 A B Output: 0 0 1; 0 1 0; 1 0 0; 1 1 0  *or*  	**2M Each**

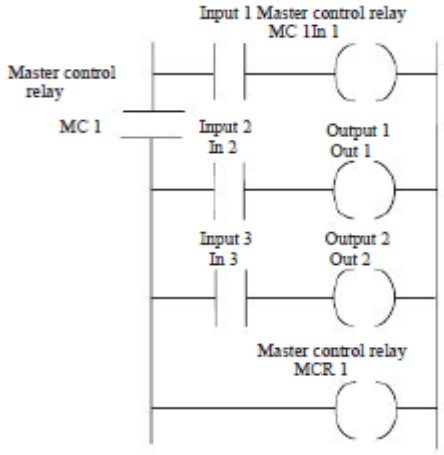


A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0



or

(d)	**Explain the master control relay used in PLC.**	**4M**
Ans:	**<u>Master control relay used in PLC</u>** • When large numbers of outputs have to be controlled, it is sometimes necessary for whole sections of ladder diagrams to be turned on or off when certain criteria are realized. This could be achieved by including the contacts of the same internal relay in each of the rungs so that its operation affects all of them. An alternative is to use a master control relay. • Figure illustrates the use of such a relay to control a section of a ladder program.	**4M**



Principle of use of a master control relay.

- With no input to input In 1, the output internal relay MC 1 is not energized, and so its contacts are open. This means that all the rungs between where it is designated to operate and the rung on which its reset MCR or another master control relay is located are switched off.
- Assuming that it is designated to operate from its own rung, we can imagine it to be located in the power line in the position shown, and so rungs 2 and 3 are off. When input
- In 1 contacts close, the master relay MC 1 is energized. When this happens, all the rungs between it and the rung with its reset MCR 1 are switched on. Thus outputs Out 1 and Out 2 cannot be switched on by inputs In 2 and In 3 until the master control relay has been switched on. The master control relay MC 1 acts only over the region between the rung it is designated to operate from and the rung on which MCR 1 is located. With a Mitsubishi PLC, an internal relay can be designated as a master control relay by programming it accordingly. Thus to program an internal relay M100 to act as a master control relay, the program instruction is:MC M100

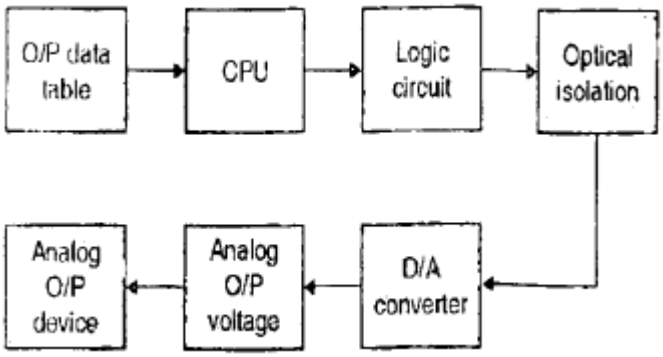
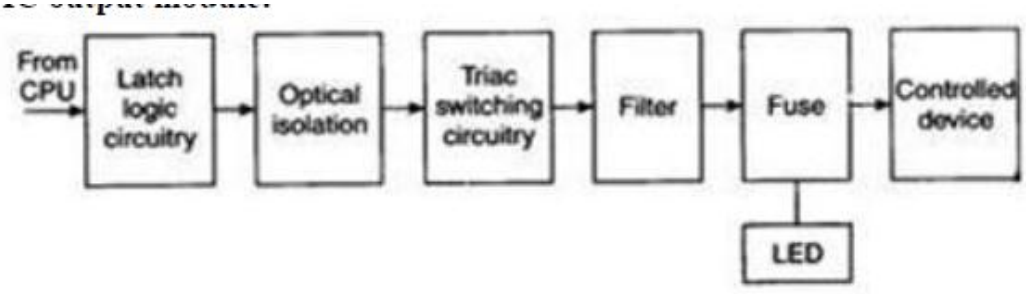
B) Attempt any ONE: 6M

(a) Classify the following devices into input and output devices w.r.t. PLC, pressure switch, Thermocouple, Motor, push button, Relay coil, toggle switch, Stepper motor, level switch, Alarm, RTD, Lamp, Sensor. 6M

Ans: **½ M each**

Input Device	Output Device
PressureSwitch	Motor
Thermocouple	Relay coil
Push Button	Stepper motor
Toggle switch	Alarm
Level switch	Lamp
RTD	
Sensor	

(b) Draw and explain analog output module. 6M

	Ans:	**Block diagram of Analog output module :**  **Explanation:-** • CPU sends data to output module through different blocks. Optical isolation blocks isolate. • CPU circuit from high voltage o/p devices. • Isolation section of the input ckt. Is usually made up of an optical isolator, or opt coupler. In a 120VAC input module, isolation separates the high voltage, 120VAC input signal from the CPUs low voltage control logic. • DC signal from the opto coupler are used by the logic section to pass the input signal to the module's input address LED and the CPU and then on to the input status file. • This module accepts 16 bit status word, convert it into analog value using DAC. • Analog signals are 0 to 10Vdc, -10Vdc to +10Vdc, 0 to 5Vdc 0 to 20mA, -20 to +20mA,4mA to 20mA.etc. • These modules are selected to send output either a varying current or voltage signal, each represent particular operation.	**3M** **3M**
Q.5		**Attempt any TWO :**	**16M**
	a)	**Draw block diagram of AC output module of PLC. Explain its working. State its any four specifications.**	**8M**
	Ans:	 **Fig. Block diagram of AC output module**	**4M**

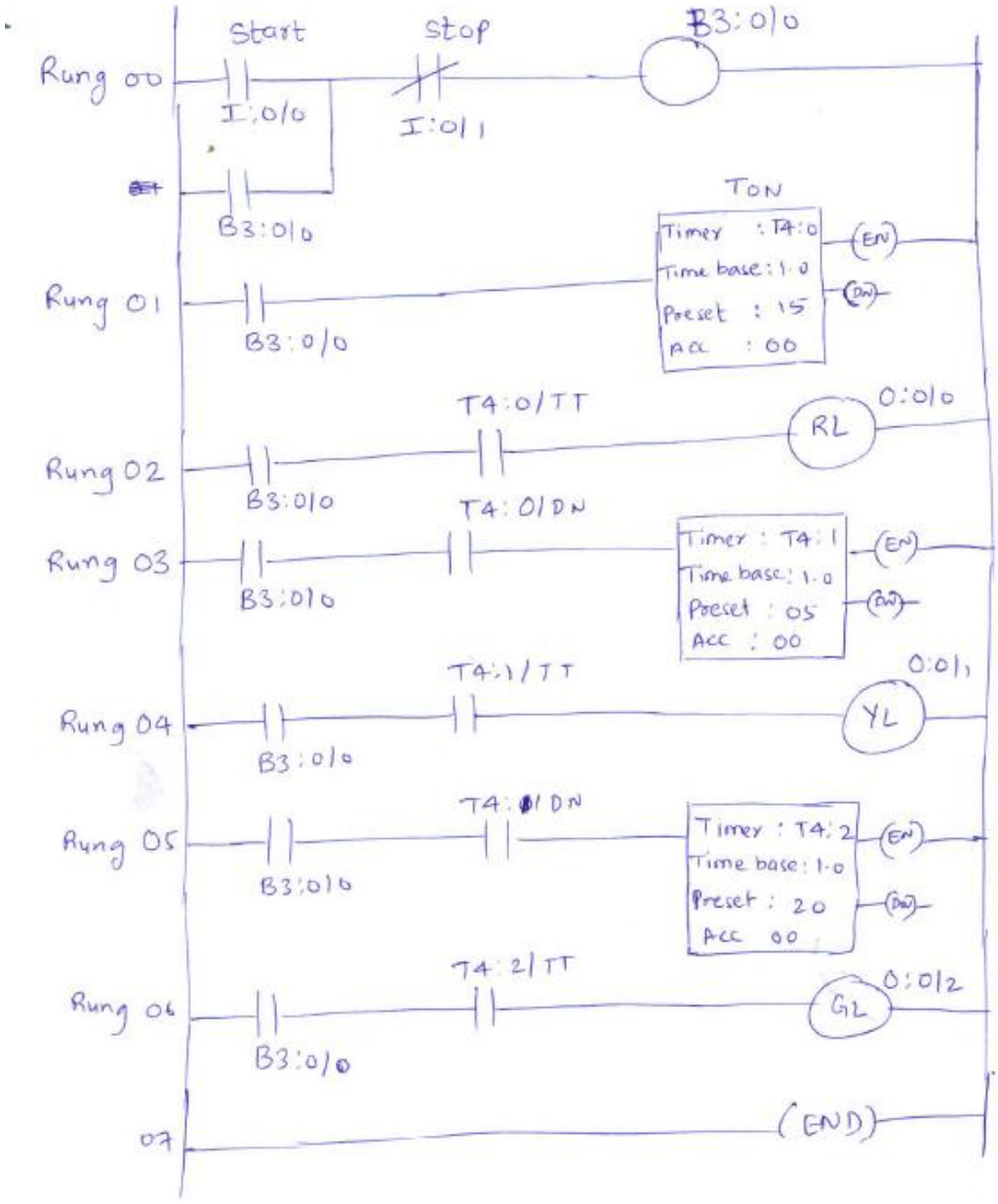
		Explanation: **Latch logic circuit and optical isolation circuit:** • If the status of output terminal is one and if CPU sends low voltage signal (12-18 V DC) to the latching circuit. • Latching circuit will latch that logic signal as a ON state and then send it to the optical isolation circuitry. • Same operation is performed for status is zero. • Optical isolation circuit will isolate low voltage signal of CPU and high voltage operating field devices. **Switching and filtering circuitry:** • In this block, TRIAC is a solid state switching device used to provide high voltage operating signal to output field devices. • TRIACs are switched ON or OFF by the signal from optical isolation circuit. • AC signals switched by TRIAC are filtered to a safe level by filtering circuitry. • To indicate the status of the output LED is provided on output module • In some output module circuit, fuse is provided to protect the circuit from drawing higher current. **Controlled device(Load):** • Controlled device are the field output devices may operate from different voltages. • When the status of output is one in output data table then controlled device turns ON and when status is zero, then device turns OFF. **Specification:(Any four)** • Switching capacity: 0.4 amp at 100-240 VAC • Leakage current : 1mA maximum at 100VAC/2mA maximum at 200VAC • ON Delay:6 milliseconds maximum • OFF Delay:1/2 cycle +5ms • Number of outputs per common:4 • PLC Power supply consumption:110 mA at 5 V dc • Fuse: 2A,one fuse per common. Fuse not user replaceable	**2M** **2M**
	b)	**Draw the ladder diagram for traffic light control:** **(i) When start push button (PB 1) is pressed system start and when stop push button is pressed system stops (PB2)** **(ii) The Red light is ON for 15 sec and then turns (RL) OFF.** **(iii) After red light is turn OFF, the yellow light turns ON and turns OFF after 05 sec.** **(iv) After yellow light is turn OFF, green light turns ON for 20 sec and then turn OFF.** **(v) The sequence repeats from step 2 again.**	**8M**
	Ans:		

List of input devices.

I:0/0 — start button.
I:0/1 — stop button.

List of output devices.

O:0/0 — Red light.
O:0/1 — Yellow light.
O:0/2 — green light.
T4:0 — TON timer 1 for 15 sec.
T4:1 — TON timer 2 for 5 sec.
T4:2 — TON timer 3 for 20 sec.

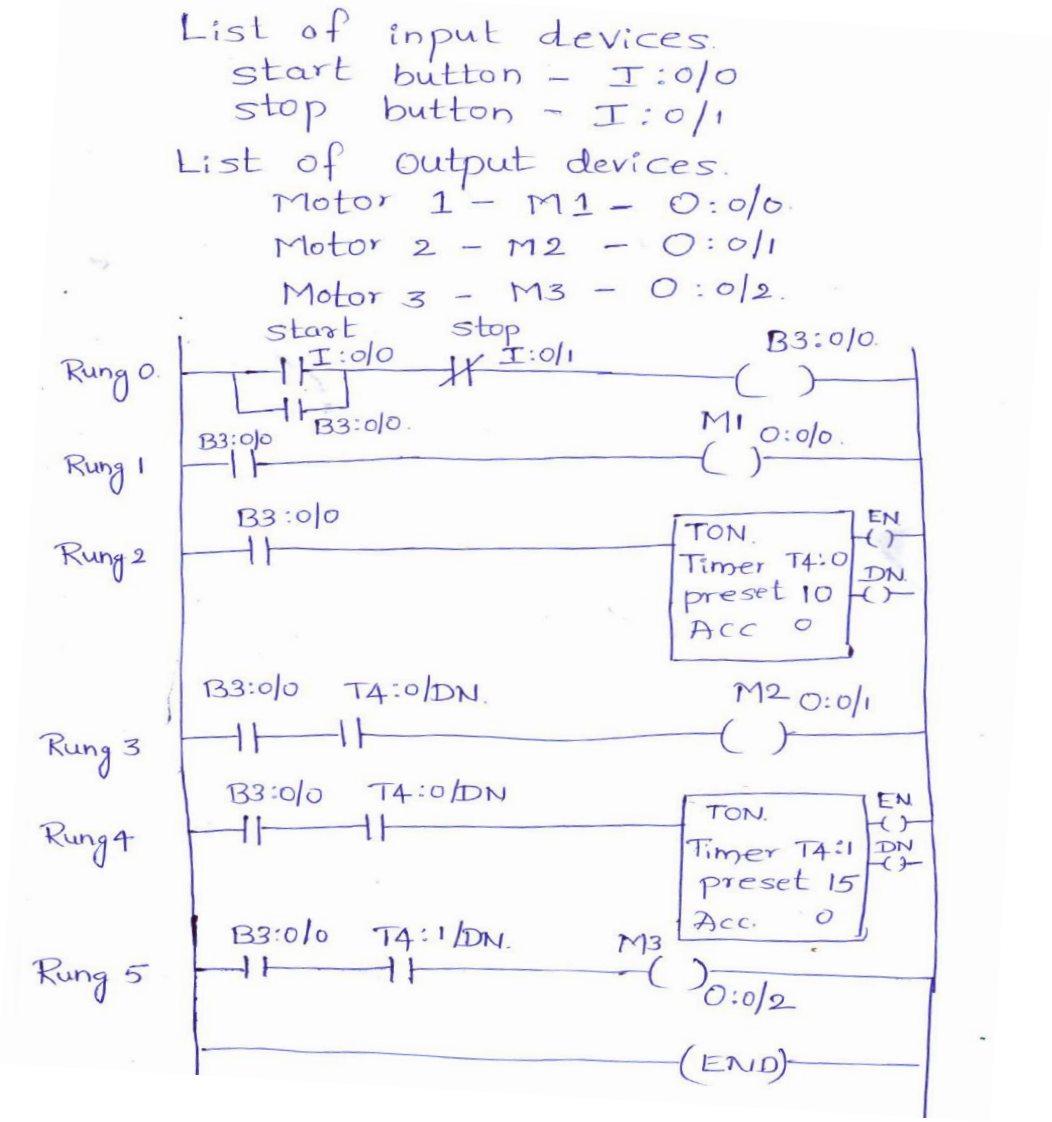


Note : Any other relevant LOGIC should be considered

Ladder program:8M

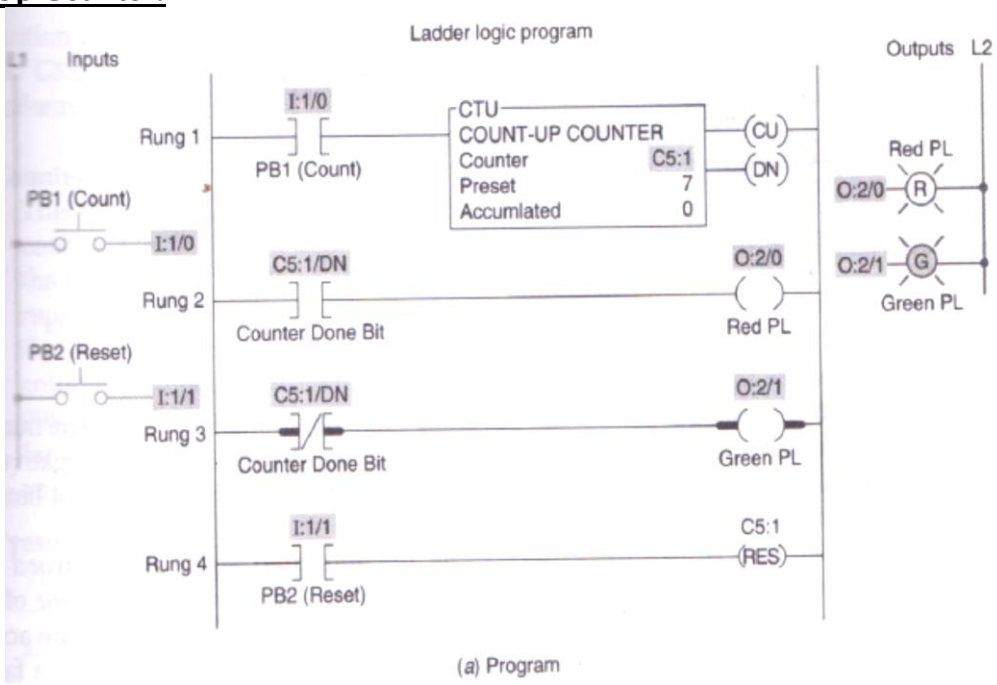
Note:
Full marks should be given to correct logic

	c)	**Draw the ladder diagram for three motor sequence control. Three DC motors need to be controlled sequentially one after another.** **(i)When start button pressed, M I will be started.** **(ii) When M 1 started, after 10 sec M2 will start.** **(iii) When M2 started, after 15 sec M3 will start.** **(iv) All the motors should stopped immediately when stop button is pressed.**	**8M**

	Ans:	**LADER PROGRAM:**  ***Note : Any other relevant LOGIC should be considered***	**Ladder program:8M** **Note:** **Full marks should be given to correct logic**
Q.6		**Attempt any FOUR:**	**16M**
	a)	**State the name of specialityI/0 modules of PLC. Explain anyone.**	**4M**
	Ans:	**Specialty I/0 modules:** 1. Communication module 2. High speed encoder input modules 3. Resistance Temperature Detector (RTD) Input modules 4. Stepper control modules 5. Thermocouple/millivolt input module	**2M for listing**

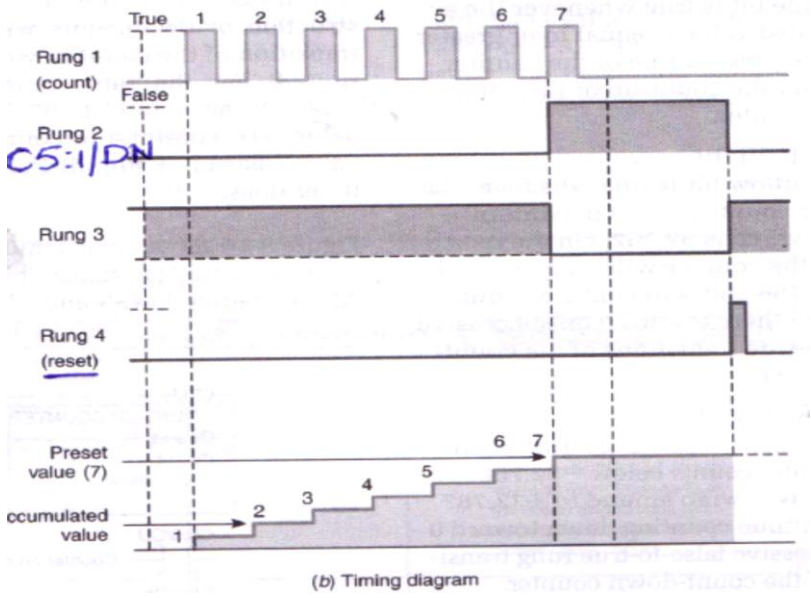
		Explanation: **1. Communication module:** **ASCII I/O Modules:** ASCII I/O modules allow the interfacing of bar code readers, meters, printers, and data terminals to a PLC. ASCII modules, which accept only valid ASCII data, are not used as extensively as they once were. Today, the RS-232 module is the module of choice in many applications. **RS-232CInterface Modules:** Communication modules are available that reside in a PLC chassis and enable you to connect a PLC to telephone lines using a modem. PLCs connected to phone lines allow central control room operators to examine ladder programs to modify or edit program operation at remote PLC sites. Today many remote oil, gas, and wastewater applications are unmanned. Remote access by way of phone lines saves maintenance personnel from driving to remote sites each time a PLC encounters aproblem or a program change is necessary. . **OR** **2.High-Speed Encoder Input Modules** When input pulses come in faster than a discrete input module can handle them, a highspeed input module is used. High-speed counters are also used to interface encoders to a PLC. **OR** **Resistance Temperature Detector (RTD) lnput Modules** A resistance temperature detector (RTD) input module interfaces a PLC to RTD temperature-sensing elements and other types of resistance input devices such as potentiometers. The RTD input module converts analog input signals from a potentiometer or. RTD into input signals understood by the PLC. These values are stored in the PLC input table. **OR** **Stepper Motor Control Modules** A stepper module is an intelligent module that resides in a PLC chassis and provides a digital output pulse train for microstepping stepper motor applications. **Thermocouple/Millivolt Input Module** The thermocouple/millivolt input module converts inputs from various thermocouple or millivolt devices into values that can be input and stored into PLC data tables. This module greatly enhances the flexibility of a PLC system by interfacing thermocouples, thus eliminating expensivethermocouple transmitters.Using an RTD module ,PLCs can thus be used for interface applications requiring temperature and measurement control.	**2M for explanation**
	b)	**List the different counter instructions ofPLC and explain anyone in detail.**	**4M**
	Ans:	**Different Counter instructions:** 1. Up Counter 2. Down Counter 3. High Speed Counter 4. Counter Reset	**2M**

1.Up Counter: **2M**



(a) Program

Waveform:



(b) Timing diagram

Explanation:

- Up counter instruction is three word instruction.

Counter Address																	
C5:N	Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
C5:N.0	Word 0	CU	CD	DN	OV	UN	UA	Internal Use (not addressable)									
C5:N.1	Word 1	Preset Value															
C5:N.2	Word 2	Accumulated Value															

C5 counter data file.

- **CU Bit:** This status bit is true when UP counter instruction is true.
- **DN bit:** This bit is true when accumulated value is equal to or greater than the present value of the counter.
- **OV(Overflow) bit:** when counter count value exceeds 32,767,this bit becomes true.
- **UN(Underflow):**It will go true when counter counts below -32,768.

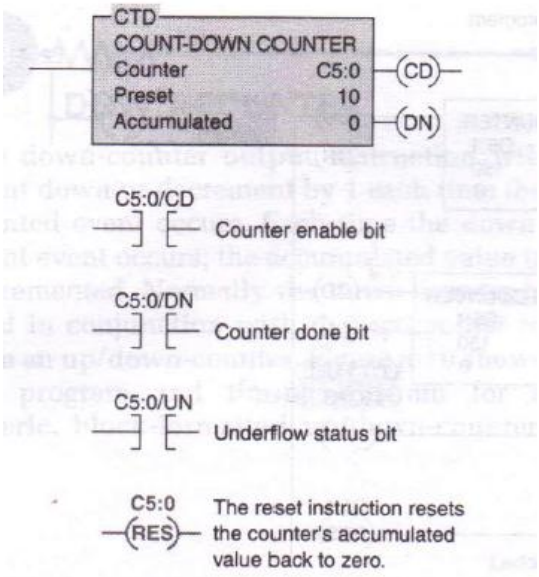
Reset instruction resets accumulated value to zero.

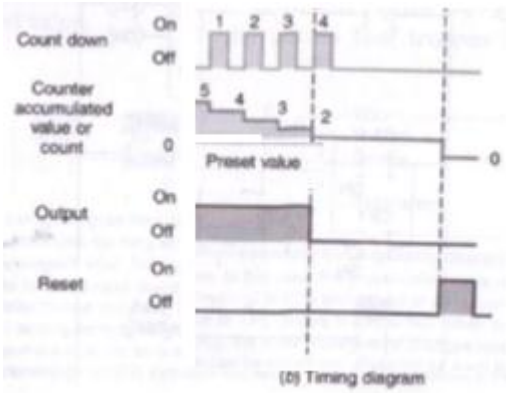
OR

2.Down counter:

Counter Address																	
C5:N	Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
C5:N.0	Word 0	CU	CD	DN	OV	UN	UA	Internal Use (not addressable)									
C5:N.1	Word 1	Preset Value															
C5:N.2	Word 2	Accumulated Value															

C5 counter data file.



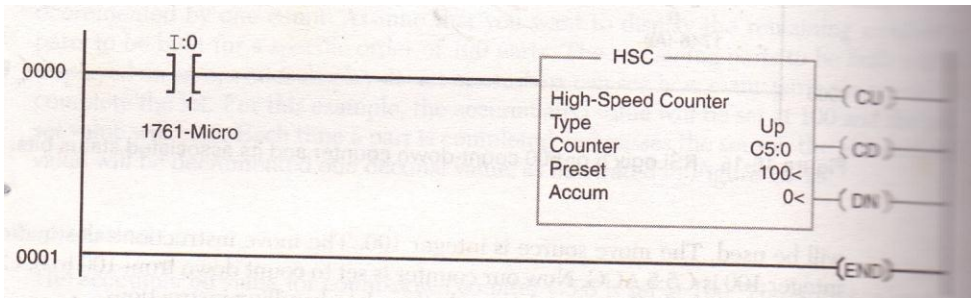


- CD Bit: This status bit is true when DOWN counter instruction is true.
- DN bit: This bit is true when accumulated value is equal to or greater than the present value of the counter.
- OV(Overflow) bit: when counter count value exceeds 32,767,this bit becomes true.
- UN(Underflow):It will go true when counter counts below -32,768.

Reset instruction resets accumulated value to zero.

OR

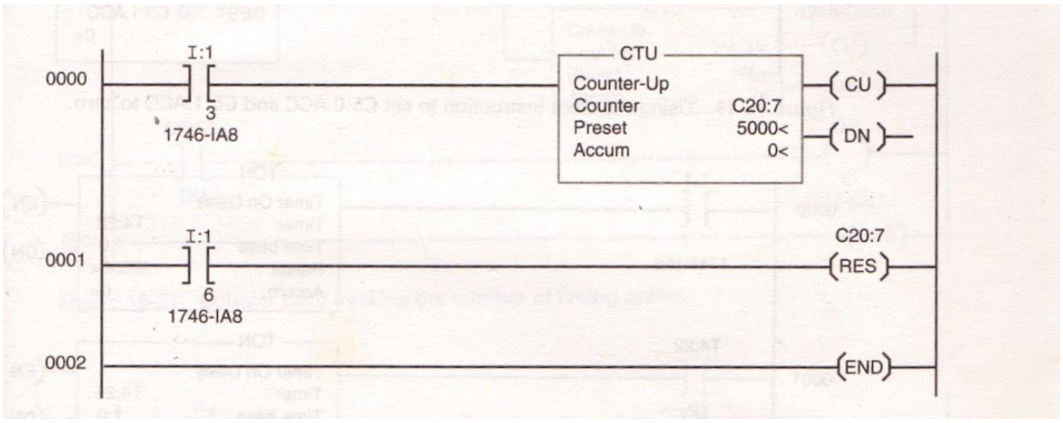
3. High Speed Counter



- This counter is similar to the CTU; however the high speed counter instruction is only enabled by the rung on which resides.
- This instruction is used to count pulses that are too fast separately from normal input points and modules.
- Most fixed PLCs will have a high speed set of input points that allow interface to high speed inputs.
- Signals from an incremental encoder would be a typical high speed input.

OR

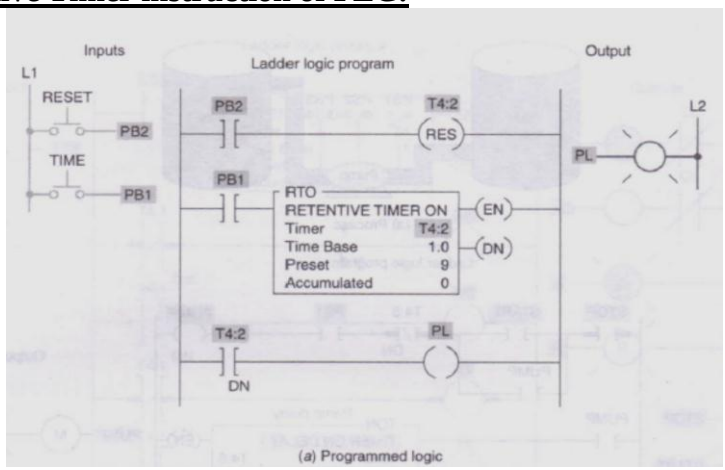
4.Counter Reset



The Reset instruction resets the counter's accumulated value back to zero
When I:1/6 is pressed C20:7 counter will reset i.e its accumulated value becomes zero.

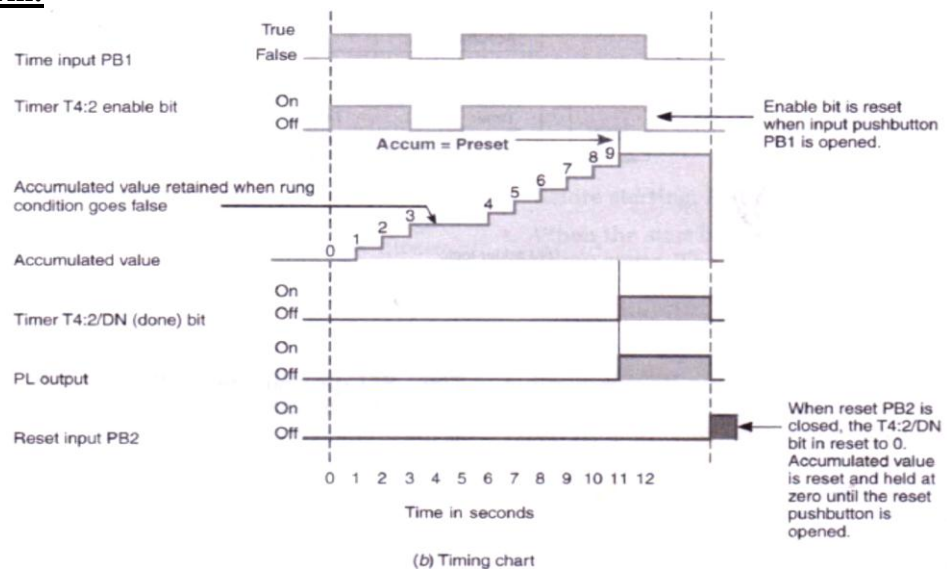
	c)	**List the important guidelines for maintenance ofPLC.**	**4M**
	Ans:	**Guidelines for maintenance of PLC: (Any eight)** 1. Periodically check the tightness of I/O Module terminal screws. They can became loose over period. 2. Periodically check for corrosion of connecting terminals. moisture& corrosion atmospheres can cause poor electrical connections . 3. Replace the PLC batteries used for backup in time. 4. Have a written check list , control list for each PLC. 5. Make sure that components are free of dust.	**1M each point**

		6. Stock commonly needed spare parts. 7. Keep duplicate record of operating programs being use. 8. Regularly monitor the temperature and humidity inside the enclosure. 9. Check the power supply if there is any voltage fluctuations. 10. Keep high voltage and noise producing devices away from PLC. **OR** ***Note-Any other relevant guidelines shall be considered***	
	d)	**Explain the retentive timer instruction of PLC with the help of waveform.**	**4M**
	Ans:	**Retentive Timer instruction of PLC:**	**1M**



(a) Programmed logic

Waveform: **2M**



(b) Timing chart

Explanation: **1M**

- Retentive on-delay timer works as same time on delay timer with the exception that when the RTO instruction goes false, it will retain its accumulated value.
- The timer will start to time when time pushbutton PB1 is closed. The timer is of 9 s.
- If the push button is opened 3s,the timer accumulated value stays at 3s.
- When PB1 is closed again,the timer up the time at 3s and continues timing.

		• When accumulated value equals the preset value,the timer dine bit T4:2/DN is set to 1 and the pilot light output PL switched on. • Because the RTOdoesnot reset to 0 when timer is de-energized,the reset instruction RES must be used to reset the timer.When PB2 closes,RES resets the accumulator value to zero and DN bit ti zero turning PL light OFF.	
	e)	**lllustrate fault detection technique for LED status of input and output module.**	**4M**
	Ans:	• PLC manufacturer usually provides LED status indicator for every input and output terminals. • There is a LED for power indication. It will be illuminated when power is ON otherwise it is off • When supply is ON but power indicator LED is OFF, it means there is a problem in power supply • Mode indicator LEDs are also on PLC which indicates the program or run mode of the PLC • For input status LED when there is a input high signal at input terminal then this LED is ON it indicates that valid input is arrived. For low input signal this LED turns OFF • If the output LED is on and the output devices is not on, test for power at the suspected output terminals. If there is a power at output terminal, the PLC is functioning. • If power is not present on PLC output terminal, the PLC has failed and must be replaced. • Next test for power at nonfunctioning output device. If there is a power at the output terminal then the device is faulty and should be fixed or replaced	**4M**