12. M

- **Methods of Measurement**–There are two method of measurement–
  - Direct measurement method
  - Indirect measurement method

> - Direct method is inaccurate. In this method the unknown quantity is directly compared against a standard.
> - Indirect method is accurate and more sensitive so this method is more preferred.

- **Instrument -**

Mechanical Instrument	• Unable to respond rapidly • Noisy, heavy and bulky • Use for static and stable condition.
Electrical Instrument	• More rapid than mechanical method. • Some inertia due to mechanical component.
Electronic Instrument	• Very fast response • Mostly used in scientific and industrial measurement

- **Accuracy level -**

Electronics Inst.>Electrical Inst.>Mechanical Inst.

i. Classification of Instruments -

Absolute Instruments	• It gives the result in terms of physical constants of the instruments. **Example -** Tangent Galvanometer & Rayleigh's current balance.
Secondary Instruments	• It can be identified by observing the output indicated by the instruments. • It needs calibration by comparison with an absolute instrument. **Example** - Ammeter, Voltmeter, Pressure gauge etc.

ii. Deflection and Null type Instrument-

Deflection Instruments	• These type of instruments have less accuracy, less sensitivity but faster response. **Example-** PMMC, Moving iron, Electrodynamometer type inst., Ohmmeter, Megger.
Null Type	• These type of instruments have high accuracy and high sensitivity. **Example-** Potentiometer, Galvanometer

Measurements and Instrumentation

iii. Recording and Integrated Type-

Recording type Instruments	• Cathode Ray Oscilloscope (CRO), Substation recording instrument and ECG.
Integrated type instrument	• 1-ϕ Energy meter (Domestic) • 3-ϕ Energy meter (Industrial)

- **Application of Measurement Systems –**
  - Monitoring of processes and operations.
  - Control of processes and operations.
  - Experimental engineering analysis.
- **Elements of a Measurement System -**
  - Primary sensing element.
  - Variable conversion element.
  - Data presentation method.
- **Measurement System Performance -**
  - Static characteristics.
  - Dynamic characteristics.
- **Static Characteristics of Instruments-**

Accuracy	• The closeness of a measured value to a standard or known value.
Precision	• The closeness of the measurements to each other.
Sensitivity	$\text{Sensitivity} = \frac{\text{Small change in output}}{\text{Small change in input}} = \frac{\Delta V_o}{\Delta V_i}$ $\text{Sensitivity} = \frac{1}{\text{Deflection factor}}$ $\text{Sensitivity} = \frac{R_m}{V_{FSD}} = \frac{1}{\left(\frac{V_{FSD}}{R_m}\right)} \Omega/\text{volt}$ $\text{Sensitivity} = \frac{1}{I_{FSD}} \Omega/\text{volt}$
Repeatability	The repetition of reading of an instrument taken over a period of time.
Reproducibility	It is define as the measure of repeatability of reading an instrument over a period of time.
Dead Time	It is defined as the time required by a measurement system to begin the respond to the change in the measurement.
Dead Zone	It is defined as the range of input value for which there is no output.
Linearity	If the output of any instrument is proportional to the input given to it, then it is called linearty.
Resolution or discrimination	The smallest change in measured value to which the instrument will respond.

Drift	For a particular value of the input, variation in output of an instrument from the desired value. There is no drift for perfect reproducibility.
Static error	It is defined as the difference between the measured value and the true value.
Hysteresis	Hysteresis is a phenomenon which depicts different output effect when loading and unloading.
Threshold	It is minimum measurable input.
Loading effect	Measurement system are used some part of energy from the input system is known as loading effect.

- **Dynamic Characteristics of Instrument**

Speed of response	It is the rapidity with which an instrument responds to changes in the measured quantity.
Measurement lag	It is the time required by an instrument to settle its final steady position after the application of the input.
Dynamic error	It is the difference between the true value of the quantity changing with time.
Fidelity	It is the ability of the system to reproduce the output in the same form as the input.

- **Errors in Measurement and Their Statistical Analysis-**

Static error or Absolute error	$\delta A = \text{Measured value} - \text{True value}$ $= A_m - A_T$ δA = Absolute static error A_m = Measured value A_T = True value **Case (i)** If $A_m > A_T$ Then, δA = +ve known error **Case (ii)** If $A_m < A_T$ δA = -ve known error **Case (iii)** if $\delta A = \pm$ ve Unknown error **Note:** It is fixed in respective of reading of the instrument
Statics Correction	$\delta C = A_T - A_m = -\delta A$
Relative limiting error or Percentage error	$\% \varepsilon_r = \left(\frac{A_m - A_T}{A_T}\right) \times 100$ $\% \varepsilon_r = \left(\frac{\delta A}{A_T}\right) \times 100$ Where, ε_r = Relative limiting error
Range	X_{min} to X_{max}
Span	$X_{max} - X_{min}$
Percentage relative accuracy	$\left[1 - \left\lvert\frac{\delta A}{A_T}\right\rvert\right] \times 100$
Guaranteed accuracy error or Accuracy error	$\% \text{ GAE} = \frac{\delta A}{\text{Span}/\text{FSD}} \times 100$ **Note:** It decreases when the pointer reaches towards full scale value

Error and desired value	$\% \ \varepsilon_r = \dfrac{\text{Error at full scale}}{\text{Desired value}} \times 100$

■ Combination of Quantities With limiting errors

- **Sum or Difference of Two or More Than Two Quantities-**

$$y = x_1 \pm x_2$$

$$\frac{\delta y}{y} \times 100 = \pm \left[\frac{x_1}{y} \times \frac{\delta x_1}{x_1} \times 100 + \frac{x_2}{y} \times \frac{\delta x_2}{x_2} \times 100 \right]$$

NOTE

- For known error = +ve/-ve
- For unknown error ±ve

- **Product or Division of Two or More Than Two Quantities-**

$$y = x_1^m \ x_2^{-n}$$

For known error –

$$\frac{\delta y}{y} \times 100 = \left[\frac{m\delta x_1}{x_1} \times 100 - \frac{n\delta x_2}{x_2} \times 100 \right]$$

For Unknown error –

$$\frac{\delta y}{y} \times 100 = \pm \left[\frac{m\delta x_1}{x_1} \times 100 + \frac{n\delta x_2}{x_2} \times 100 \right]$$

+ve $\Rightarrow$ For maximum possibility

NOTE

- In case of addition and subtraction, the error in value form simply added but not in percentage form for unknown error.
- In case of multiplication and division, the error in percentage form simply added but not in value form, for unknown error.

■ Statistical Error

- **Arithmetic Mean Value-**

$$\text{Mean value}\left(\bar{x}\right) = \frac{x_1 + x_2 + ...x_n}{n} = \frac{\sum x}{n}$$

Where, $x_1, x_2, ...x_n$ = Readings

n = No. of readings

- **Deviation-**

$$\boxed{d_n = x_n - \bar{x}}$$

Where, $\bar{x}$ = Mean value of readings

x_n = Readings to the n value

- **Average Deviation-**

Mean or Average deviation -

$$\bar{D} = \frac{\sum |d|}{n} = \frac{|d_1| + |d_2| + ...|d_n|}{n}$$

Note : It indicate the precision of an instrument.

- **Standard Deviation-**

$$\text{S.D.} = \sigma = \sqrt{\frac{\sum d^2}{n}} = \sqrt{\frac{d_1^2 + d_2^2 + ... + d_n^2}{n}}, \text{ For } n > 20,$$

$$\text{S.D.} = \sigma = \sqrt{\frac{\sum d^2}{n-1}} = \sqrt{\frac{d_1^2 + d_2^2 + ... + d_n^2}{n-1}}, \ n \le 20,$$

- **Variance–**

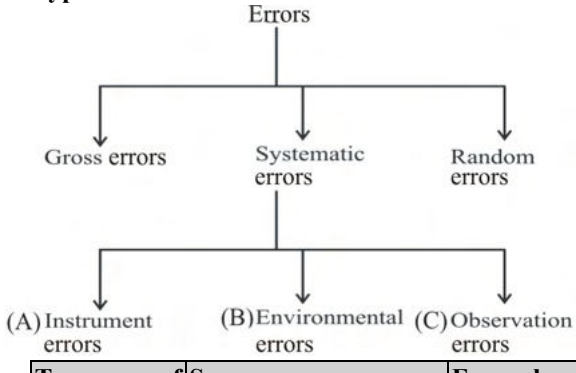
Variance (V) = σ^2 = (Standard deviation)^2

$$V = \sigma^2 = \frac{\sum d^2}{n}, \text{ For } n > 20$$

$$V = \sigma^2 = \frac{\sum d^2}{(n-1)}, \; n \le 20$$

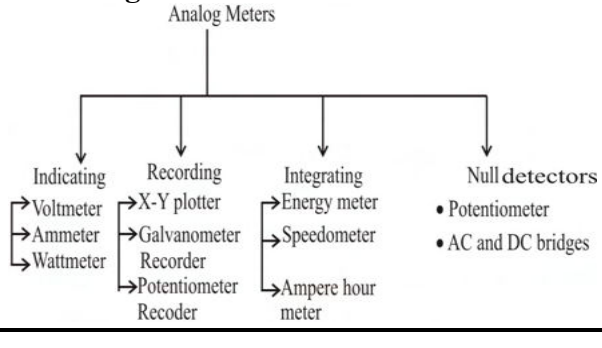
Where, σ = Standard deviation, d = Deviation

- **Types of Errors-**



Types of Errors	Source	Example
Gross Error	The class of error mainly covers human mistakes	Wrong calculation, Misreading, Blunder, wrong selection of instruments
Systematic Error	**(A)**(i)Due to inherent short comings in the instrument (ii) Due to misuse of the instrument (iii) Due to loading effects of instrument **(B)** These are the error due to temperature humidity and stray magnetic field. **(C)** Parallax error	(A)(i) Use of PMMC with AC. (ii)Frictional error. (iii)Zero not adjust.
Random or Accidental or Residual or Possible error	It's occurs randomly and its magnitude and sign are not known.	

■ Analog Instruments



- **Principles of operation**

Effect	Instruments
Magnetic Effect	Ammeters, Voltmeters, Wattmeters and Energy meters.
Heating Effect	Ammeters and Voltmeters
Electrostatic Effect	Voltmeters
Induction Effect	AC ammeters, Voltmeters, Wattmeters and Energy meters.
Hall Effect	Flux meters, Ammeters and Poynting vector wattmeter.

■ Electromechanical Indicating Instruments-

- **Operating Torque/ Forces -**

(i) Deflecting Torque
(ii) Controlling Torque
(iii) Damping Torque

- **Deflecting Torque**

$$\text{Deflecting torque } (T_d) \propto \text{Measurable quantity}$$

- **Controlling Torque**

Spring Control	Gravity Control
They should not be magnetic	In this type of control a weight produced a controlling torque due to gravity.
They should be proof from mechanical fatigue	It must be used in vertical position.
It should have low temperature coefficient of resistance.	It is cheaper
Its most suitable material is Phosphor bronze.	Its control is independent of temperature variations
Flat spiral springs are used.	It does not deteriorate with time.

- **Damping Torque**

Air friction damping	It is used when there is an electromagnet in the instrument **Example-** EMMC, MI
Fluid friction damping	It is used when deflecting torque is poor **Example-** ESV
Eddy current damping	It is preferred when there is permanent magnet is used or where strong magnetic field is available. **Example-** PMMC, Energy meter, Hot wire, induction type.
Electromagnetic damping	When coil move in a magnetic field then due to current a damping torque is developed in the coil. **Example-**Galvanometer, Flux meter.

NOTE

(i) Analog instrument are of 2nd order type of instrument which has a damping factor, $\delta = 0.6$ to 0.8, under damped, damping is used.
(ii) T_c depends on T_d but damping torque is independent of T_c and T_d.

- **Preference and Efficient of The Damping Torque**

Preference	Air friction>Eddy current>Fluid friction
Efficient	Eddy current>Fluid friction>Air friction

■ Analog Ammeters and Voltmeters

- **Types of Instruments -**

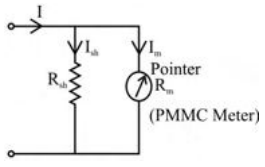
(i) Permanent magnet moving coil (PMMC)
(ii) Moving iron (MI)
(iii) Electro-dynamometer (EDM)
(iv) Hot wire
(v) Thermocouple
(vi) Induction
(vii) Electrostatic
(viii) Rectifier

- **PMMC (Permanent Magnet Moving Coil/ D'Arsonval Instrument)-**

Principle	Magnetic effect
Deflecting Torque	$T_d = BI_mNA$ $A = \text{length} \times \text{breadth} = \text{Area}$
Controlling Torque	Controlling torque is provided by two phosphor bronze hair springs. $T_C = k\theta$
Damping Torque	Damping torque is provided by Eddy current damping.
Scale	The pointer is carried by the spindle and moves over a graduated scale, the pointer is of light weight construction & uniform (linear) scale.
Range	**D.C. Ammeter** • instrument alone $0-5\mu A$ to $0-20mA$ • With internal shunts upto 0-200A • With external shunts, upto-0-5000A **D.C. Voltmeter** • Instrument alone 0-50 or 0-100 mV. • With series resistance upto 20000 - 30000V.
Sensitivity	$S_{pmmc} = \frac{\Delta\theta}{\Delta I_m} = \frac{BAN}{K} \propto \frac{\text{Torque}}{\text{Weight}}$
Advantages	• No frequency error • Highest internal magnetic field (0.1T to 1T) • Highest sensitivity (20 $k\Omega/V$ to 30 $k\Omega/V$) • Highest accuracy • Scale is linear
Disadvantage	• It work only with DC • Always reads average value.

- **Range Extension of PMMC type Ammeter:**

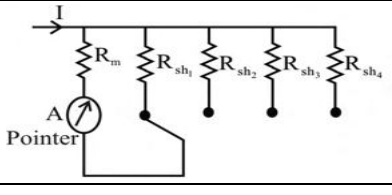
Shunt material	Manganin constantan
Connection of Shunt	Parallel connection
Property of shunt	• Low resistance • Does not change with temperature

Circuit Diagram	 $I = I_{sh} + I_m$ R_m = Resistance of PMMC instrument R_{sh} = Resistance of shunt I = Total input current I_{sh} = Current through shunt I_m = Current through instrument m = Shunt multiplying factor
Value of shunt resistance	$R_{sh} = \frac{R_m}{(m-1)}$, $m = \frac{I}{I_m}$ Where, m = Multiplying factor of shunt

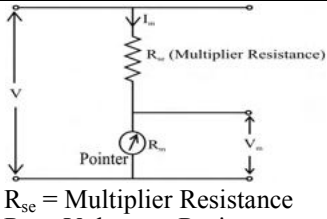
- **Swamp Resistance-**

Function	To eliminated the effect of the temperature
Connection	Series with ammeter
Material	Manganin (DC) , Constantan (AC)
Value	$R_{sh} = \left(\frac{R_m + R_{swamp}}{m-1}\right)$ 20 to 30 times of meter resistance (R_m)

- **For Multi-Range Ammeters-**

Circuit Diagram	
Value	$R_{sh_1} = \frac{R_m}{m_1 - 1}$, $m_1 = \frac{I_1}{I_m}$

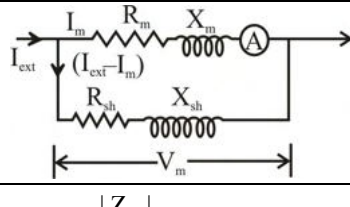
- **Range Extension of Voltmeter-**
  Used a series multipliers

Material	Manganin, constantan
Connection	Series connection
Property	• High resistance • Does not change with temperature
Circuit Diagram	 R_{se} = Multiplier Resistance R_m = Voltmeter Resistance V = Supply Voltage V_m = Voltage across PMMC voltmeter I_{FSD} = Full scale deflection current
Value	$R_{se} = R_m (m-1)$, $m = \frac{V}{V_m}$

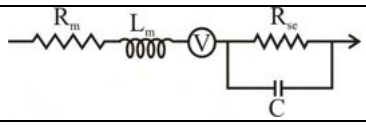
- **Moving Iron Instrument (MI)-**

Principle	Magnetic effect
Types	**i.** Attraction type **ii.** Repulsion type
Deflecting Torque	$\boxed{T_d = \frac{1}{2} I^2 \frac{dL}{d\theta}}$
Controlling Torque	$\boxed{T_C = k\theta}$ At steady state position $\theta \propto I^2$
Damping Torque	Air friction damping
Scale	Non – linear
Frequency Range	0 to 125 Hz
Advantages	• Universal use for both AC and DC • Less friction error • Cheapness • Robustness
Disadvantages	• Accuracy-less • **Scale-**Non uniform and is cramped at the lower end • **Error-** Due to hysteresis, frequency changes and stray magnetic field • Waveform error • Different calibration between AC and DC

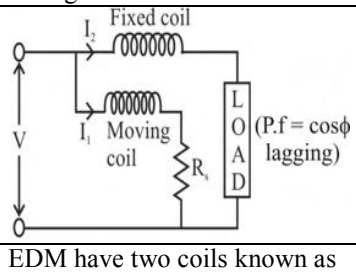
- **Range Extension of MI Type Ammeter**
  To extend the range of MI ammeter we connect an impedance across the meter.

Connection	Across the ammeter
Circuit Diagram	
Value	$\lvert Z_{sh} \rvert = \frac{\lvert Z_m \rvert}{\lvert m-1 \rvert}$ Where , $m = \frac{R_m\sqrt{1+\left(\frac{\omega L_m}{R_m}\right)^2}}{R_{sh}\sqrt{1+\left(\frac{\omega L_{sh}}{R_{sh}}\right)^2}} + 1$
Value of m For Independent of Frequency	$\boxed{\frac{L_m}{R_m} = \frac{L_{sh}}{R_{sh}} \Rightarrow \tau_m = \tau_{sh}}$ τ_m = Meter time constant τ_{sh} = Shunt time constant

- **Range Extension of MI Type Voltmeter -**
  To extend the range of MI voltmeter we connects a series multiplier

Connection	Series with voltmeter
Circuit	
Value	$R_{se} = (m-1)\lvert Z_m \rvert$ $m = \frac{R_{se}}{\sqrt{R_m^2 + \omega^2 L_m^2}} + 1$
Eliminate Frequency Error	We connect a capacitor in parallel with R_{se}
Value of C	$C = 0.41\frac{L_m}{R_{se}^2}$

- **Electrodynamometer Type Instrument (EDM)**

Principle	Change in mutual inductance
Circuit Diagram	
Construction	EDM have two coils known as fixed coil and moving coil both are air cored.
Deflecting Torque	$\boxed{T_d = i_1 i_2 \frac{dM}{d\theta}}$ At steady state, $\boxed{\theta = \frac{i_1 i_2}{k}\frac{dM}{d\theta}}$
Control Torque	$\boxed{T_C = K\theta}$ Provided by spring control
Damping Torque	Air friction damping
Shielding	Due to low magnetic field (0.005 to 0.006 Wb/m^2) a casing is provided with high permeability alloy.
Cases and Scale	A glass is coated the some conducting material to completely remove the electrostatic effect. Most of high precision instruments have a 300mm scale with 100, 120 or 150 division.
Range	**Ammeters** • Fixed and moving coils in series - upto 200 mA • In moving coil ammeter shunted-upto 30A and voltmeter shunted upto 750 V
Frequency Range	Upto 10 kHz
Sensitivity Range	10 Ω/V to 20 Ω/V
Errors	Low torque/weight ratio, frequency error, eddy current, external magnetic fields and temperature changes.

Advantage	• Free from hysteresis error • They have a precision grade accuracy for frequencies upto 40 to 500Hz • Used on both AC and DC, they are very useful as transfer instrument
Disadvantage	• Low torque/weight ratio and hence has a low sensitivity. • More costly than the PMMC or the moving iron type instrument • More sensitive to over loads and mechanical impacts. • Higher power consumption as compared with PMMC • Non uniform scale

- **Electro-Thermic Instruments-**

Principle	**Electro-Thermic Effect**
Types	• Hot wire instrumets → RF instrument / → True RMS meter • Thermocouple Instruments • Bolometers
Deflecting Torque	$T \propto I_{rms}^2$ $E = a(\Delta t) + b(\Delta t)^2$ follow perfect square law
Control Torque	Spring control
Damping Torque	Eddy current damping
Frequency Range	For MHz
Advantage	• Thermocouple measures rms value of voltage or current . • Not affected by stray magnetic fields. • Free from frequency error and hence they can be used over a very wide frequency range. • They are superior to any other type of instrument both in accuracy and frequency range. • Its accuracy high as 1% for frequency upto 50 MHz • High sensitivity • Used as transfer type instrument
Disadvantage	• Over load capacity of thermo-couple instrument is small as compared with other instruments and it is about 150% of the full scale.
Range	• Vacuum type thermo-couple- 1.25 mA to 1A • With air cooling fins - 50 A above

- **Electrostatic Instruments -**

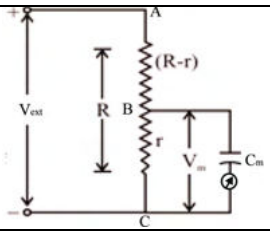
Electrostatic Voltmeter (ESV) :

Principle	• Change in capacitance
Deflecting Torque	• $T_d = \frac{1}{2} V^2 \frac{dC}{d\theta}$
Controlling Torque	• $T_C = K\theta$ • $\theta \propto V^2$

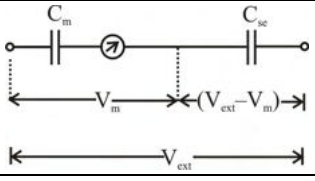
Damping Torque	• Fluid friction damping.
Advantage	• Draw negligible power from the supply mains. • Used on both AC and DC • No frequency and waveform error. • No error caused by stray magnetic fields. • For high voltage
Disadvantage	• More expensive, large in size. • Scale is non uniform. • Operating force is small.

- **Range Extension of Electrostatic Voltmeters-**
  There are two method

i. By Using Potentiometer

Circuit Diagram	
Formula	$m = \frac{V_{ext}}{V_m} = \frac{R_{AC}}{R_{BC}} = \frac{L_{AC}}{L_{BC}}$ m = Multiplying factor

ii. By Using Series Capacitance :-

Circuit Diagram	
Formula	$C_{se} = \frac{C_m}{m-1}$ $m = \frac{V_{ext}}{V_m}$ C_m = Capacitance of voltmeter C_{se} = Capacitance in series with voltmeter

- **Rectifier Type Instrument-**

Principle	Magnetic effect
Types	Half wave Rectifier meter Full wave Rectifier meter
Used	For low voltage, low current, low power, high Resistance
Deflecting Torque	$\theta \propto I$
Controlling Torque	Spring Control
Damping Torque	Eddy current damping
Reading	$k_f \times$ PMMC reading
Advantage	• Frequency range 20 Hz to high audio frequencies • Low power consumption except electrostatic • For most ranges, they have a practically uniform scale.

Disadvantage	• Reduced sensitivity ($S_{AC} < S_{DC}$) • Change in diode resistance due to temperature error • One instrument can be used for only one waveform.

- **Half Wave Rectifier Meter -**

Output voltage DC	$(V_o) = V_{DC} = V_{avg} = \frac{V_m}{\pi}$ $(V_o) = V_{avg} = 0.45\ V_{rms}$
Input Voltage	$V_{AC} = \frac{V_m}{\sqrt{2}}$
Form Factor for sin Wave	$\frac{\text{RMS value of AC wave}}{\text{Average value of DC wave}} = 2.22$
F.F. for Saw Tooth Wave	$V_{AC} = 2.30\ V_{DC}$
Reading	2.22 × PMMC reading.

Summary of Ana

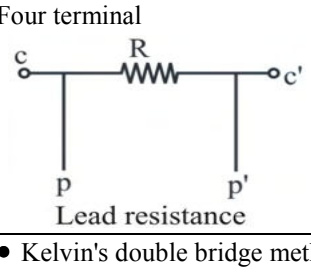
Type	Principle	Controlling	Deflec
PMMC	Magnetic effect	Spring	$\theta \propto I$
EMMC (EDM)	Electro magnetic effect	Spring	$\theta \propto I^2$
Moving Iron (MI)	Magnetic effect	Gravity/Spri ng	$\theta \propto I^2$
Electrostatic	Electrostatic effect	Spring	$\theta \propto V^2$
Rectifier	Magnetic effect	Spring	$\theta \propto I$
Induction Type	Induction effect	Spring	$\theta \propto I_m^2$
Hot Wire	Heating effect	Spring	$\theta \propto I^2$
Thermocouple	Seebeck effect	Spring	$\theta \propto I^2$

■ Measurement of Resistance

- **Classification of Resistance-**

Classification	Value of R
Low resistance	$R \le 1\Omega$
Medium resistance	$1\Omega < R < 100\,k\Omega$
High resistance	$R > 100\,k\Omega$

A. Measurement of low Resistance -

Diagram	Four terminal 
Method	• Kelvin's double bridge method • Potentiometer method

Sensitivity	$S_{AC} = 0.45\ S_{DC}$

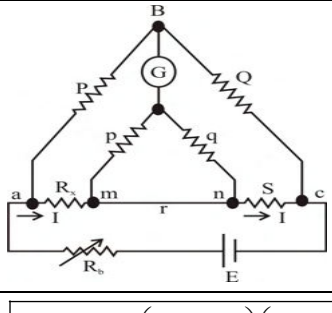
- **Full Wave Rectifier Meter-**

Output Voltage	$V_o = V_{DC} = V_{avg} = \frac{2V_m}{\pi}$ $V_{avg} = 0.9\ V_{rms}$
Input Voltage	$V_{AC} = \frac{V_m}{\sqrt{2}}$
Form Factor for sin Wave	$\frac{V_{AC}}{V_{DC}} = \frac{V_m/\sqrt{2}}{2V_m/\pi} = 1.11$
F.F. for Sawtooth Wave	$V_{AC} = 1.15 V_{DC}$
Reading	$1.11\times$ PMMC reading
Sensitivity	$S_{AC} = 0.9\ S_{DC}$

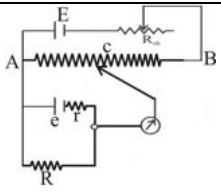
alog Instruments

ting	Damping	Power supply	Use
	Eddy current	DC	Voltmeter, Ammeter
	Air friction	AC or DC	Voltmeter, Ammeter, Wattmeter, Power factor meter, Frequency meter
	Air friction	AC or DC	Ammeter, Voltmeter
	Fluid friction	AC or DC	Voltmeter
	Eddy current	AC or DC	Ammeter, Voltmeter
ns	Eddy current	AC	Energy meter, Wattmeter, Voltmeter, Ammeter
	Eddy current	AC or DC	Ammeter, Voltmeter
	Eddy current	AC or DC	Voltmeter, Ammeter

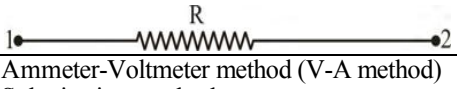
- **Kelvin's Double Bridge Method**

Circuit Diagram	
Balance Condition	$R_x = \frac{P}{Q}.S + \left(\frac{qr}{p+q+r}\right)\left(\frac{P}{Q} - \frac{p}{q}\right)$ ➢ Include lead resistance
Eliminate Lead /Contact Resistance	$\frac{P}{Q} = \frac{p}{q}$ then, $R_x = \frac{P}{Q}.S$

- **Potentiometer Method-**

Principle	Based on comparison method.
Circuit Diagram	
Formula	$r = R\left(\frac{L_{AC_1}}{L_{AC_2}} - 1\right)$ $L_{AC_1} > L_{AC_2}$

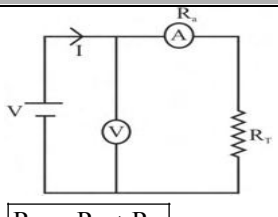
B. Measurement of Medium Resistance-

Diagram	Two terminal 
Method	Ammeter-Voltmeter method (V-A method) Substitution method Wheatstone bridge method Ohmmeter method

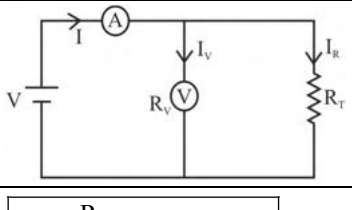
- **Ammeter-Voltmeter Method-**

Principle, $R_m = \frac{V}{I}$

Case (i)- Ammeter Near to Unknown Resistance

Circuit Diagram	 $R_m = R_a + R_T$ R_a = Ammeter internal resistance R_T = Test resistance R_m = Measured value of resistance
Error	$\% \text{ error} = \left(\frac{R_m - R_T}{R_T}\right) \times 100$ $\downarrow \% \text{ error} = \left(\frac{R_a \downarrow}{R_T \uparrow}\right) \times 100$
Use	Best for medium resistance measurement

Case (ii)-Voltmeter Near to Unknown Resistance-

Circuit Diagram	
Error	$\varepsilon_r' = \frac{-R_T}{R_V}$ $\downarrow \% \text{ error} = \frac{-R_T \downarrow}{R_V} \times 100$
Use	Best for low resistance measurement

When Error in Both Cases are Same-

$|\varepsilon_r| = |\varepsilon_r'|$

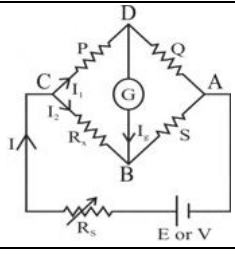
$$\frac{R_a}{R_T} = \frac{R_T}{R_V} \quad \boxed{R_T = \sqrt{R_a R_V}}$$

R_a = Ammeter internal resistance

R_V = Voltmeter internal resistance

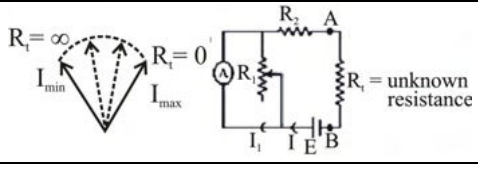
R_T = Test resistance or Unknown resistances

- **Wheatstone Bridge Method-**

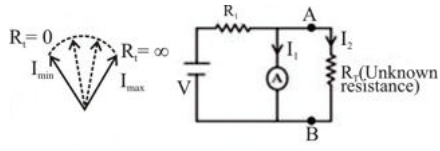
Principle	Null deflection
Circuit Diagram	
Formula	$\frac{P}{Q} = \frac{R_x}{S}$, $\quad R_x = \left(\frac{P}{Q}\right)S$
Error	• Error due to temperature • Error due to contact • Error due to lead resistance • Error due to thermal emf.
Current Sensitivity (S_i)	$\boxed{S_i = \frac{\theta}{I_g}}$ (mm / μA)
Voltage Sensitivity (S_V)	$\boxed{S_V = \frac{\theta}{V_{Th}}}$ (mm / V)
Bridge Sensitivity (S_B)	$\boxed{S_B = \frac{\theta}{(\Delta R / R)}}$ mm or $\boxed{S_B = \frac{S_i I_g}{(\Delta R / R)}}$ mm
Max Value of Bridge Sensitivity	$\boxed{S_{B_{max}} = \frac{VS_V}{4}}$ occurs when, $\frac{P}{Q} = \frac{R}{S} = 1$

- **Ohm-Meter Method**

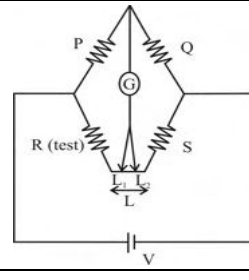
i. Series Ohmmeter

Circuit Diagram	
Formula	$R_T = R_2\left[\frac{I_{FSD}}{I_m} - 1\right]$ When, AB is open $\rightarrow I_{min} = I_1 = 0$ and $R_t = \infty = Max$ AB is short $\rightarrow I_1 = I_{max}$ and $R_t = Min$
Use	For medium resistance, Checking diode, capacitor whether it is all right or damaged

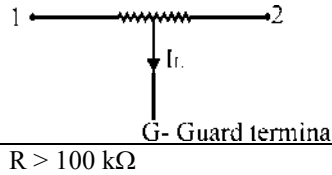
ii. Shunt Ohm Meter

Circuit	
Result	If R = 0 then $I_m = 0$ if R = ∞ Ω then $I_m = I_{max.}$ Commonly not used.

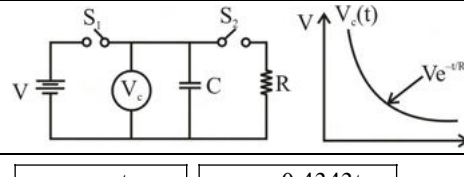
- **Carey Foster Slide Wire Bridge-**

Circuit Diagram	
Formula	$\frac{P}{Q}+1=\frac{R+S+Lr}{S+(L-\ell_1)r}$ .....(i) $\frac{P}{Q}+1=\frac{R+S+Lr}{R+(L-\ell_2)r}$ .....(ii) $\boxed{R-S=(\ell_2-\ell_1)r}$
Use	Carey Foster bridge method is used for medium resistance measurement by comparing standard resistance.

C. Measurement of High Resistance

Diagram	Three terminal 
Range	R > 100 kΩ
Method	• Loss of charge method • Megger • Direct deflection method • Mega ohm Bridge

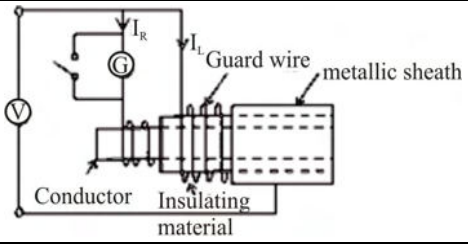
- **Loss of Charge Method-**

Principle	• Charging and discharging of capacitor through unknown resistor.
Circuit Diagram	
Formula	$\boxed{R=\frac{t}{C\,\ell n\left(\frac{V}{V_C}\right)}}$ $\boxed{R=\frac{0.4343t}{C\log_{10}\left(\frac{V}{V_C}\right)}}$ MΩ Where, t = Time in second V = Supply voltage R = Unknown resistance V_C = Voltage across capacitor

- **Megger Method**

Principle	Based on electrodynamometer.
Formula	$\text{Deflection}(\theta) \propto \dfrac{1}{\text{Unknown resistance}(R_T)}$ $\tan\theta = \dfrac{I_2}{I_1}, \ \theta \propto \dfrac{I_2}{I_1}$
Property	• No need of external supply • Used for the measurement of insulation resistance of cables, bushing insulation. • There is a coil control technique • Megger is a three terminal device

- **Direct Deflection Method-**

Circuit	
Reading	$R = \dfrac{\text{Reading of Voltmeter}}{\text{Reading of Ammeter}}$
Use	• For finding the surface resistivity of an insulator.

❑ Measurement using A.C. Bridges

- **Depending Upon Phase Angle θ, Elements are.**

Phase angle (θ)	Elements
0º	R
90º	L_1
–90º	C_1
0º < θ < 90º	R_1, L
–90º< θ< 0º	R_1, C_1

- **AC Bridges Used For -**

i. Measurement of unknown impedance and associated parameters like inductance, capacitance, and resistance respectively.

ii. Measurement of dissipation factor (tan δ) and electrical permittivity.

iii. Measurement of unknown frequency of audio signal.

- **Sources-**

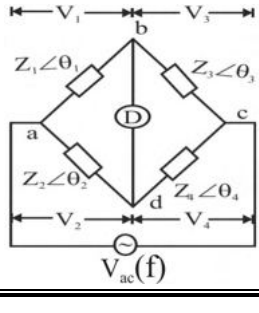
a. For Low Frequency-Power line supply can be used.

b. For High Frequency- Electronic oscillator is used.

■ AC Bridge-

- **General Equation For Bridge Balance-**

☞

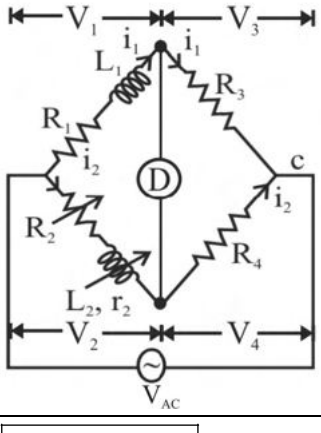
Circuit Diagram	

Condition	$\lvert Z_1 \rvert \lvert Z_4 \rvert = \lvert Z_2 \rvert \lvert Z_3 \rvert$ $\angle\theta_1 + \angle\theta_4 = \angle\theta_2 + \angle\theta_3$
Detector	Vibration Galvanometer- 5Hz to 1 kHz Headphone - 250 Hz to 4 kHz Tuned Amplifier - 10Hz to 100 kHz D'Arsonval Galvanometer – 0 Hz

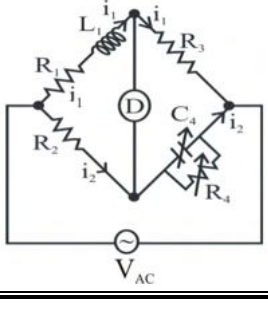
- **Measurement of Self Inductance-**

➲	Maxwell's Bridge – (1<Q<10) - It measures medium Q of coil
➲	Maxwell's Inductance Capacitance Bridge
➲	Hay's Bridge(Q>10) - It measures high Q of coil
➲	Anderson's Bridge (Q<1) - It measures low Q of coil
➲	Owen's Bridge- It measure incremental inductance

i. Maxwell's Inductance Bridge-

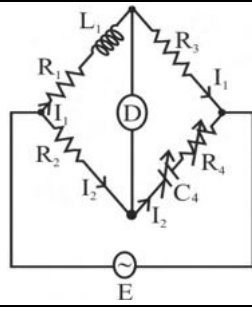
Circuit Diagram	
Formula	$R_1 = \frac{R_3}{R_4}(R_2 + r_2)$ $L_1 = \frac{R_3}{R_4}.L_2$ Where , L_1= Unknown inductance L_2 = Variable inductance R_2 = Variable resistance R_3, $R_4 \rightarrow$ Known non-inductive resistance. R_1 = Unknown resistance

ii. Maxwell's Inductance Capacitance Bridge-

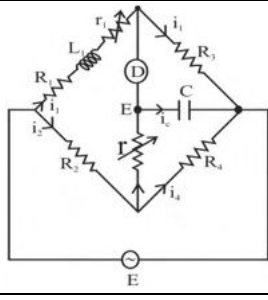
Circuit Diagram	

Formula	$R_1 = \frac{R_2R_3}{R_4}, L_1 = R_2R_3C_4$ $Q = \frac{\omega L_1}{R_1} = \omega C_4 R_4$
Range	It measures medium Q of coil (1< Q < 10)
Advantage	Useful for the measurement of a wide range of inductance at power and audio frequency
Disadvantage	Very expensive due to standard capacitor

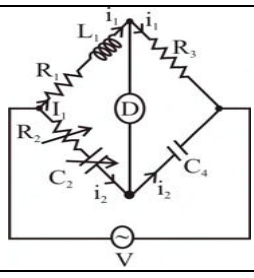
iii Hay's Bridge-

Circuit	
Formula	$L_1 = \frac{R_2R_3C_4}{\left(1+\omega^2R_4^2C_4^2\right)}$ $R_1 = \frac{\omega^2R_2R_3R_4C_4^2}{1+\omega^2R_4^2C_4^2}$ $Q = \frac{1}{\omega R_4C_4}$
Range	Q > 10
Advantage	Very simple for high Q
Disadvantage	It is slowest bridge

iv. Anderson's Bridge

Circuit Diagram	
Formula	$R_1 = \frac{R_2R_3}{R_4} - r_1$ $L_1 = C\frac{R_3}{R_4}\left[r(R_4+R_2)+R_2R_4\right]$
Range	Very low Q of coil (Q < 1)
Advantage	Used for accurate determination of inductance in terms of capacitance
Disadvantage	More complex than its prototype maxwell's bridge

v. Owen's Bridge-

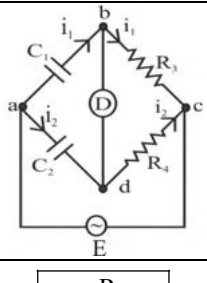
Circuit Diagram	
Formula	$L_1 = R_2 R_3 C_4$ $R_1 = \frac{C_4}{C_2} R_3$ $Q = \frac{\omega L_1}{R_1} = \omega R_2 C_2$
Measure Quantity	• It is used for the measurement of self inductance with a wide range. • Used for measurement of incremental inductance. • Suitable for medium Q-factor measurement.
Advantage	Equation are quite simple and do not contain any frequency component.
Disadvantage	Value of capacitance C_2 becomes high when measuring High Q Coil.

- **Measurement of Mutual Inductance-**
- Heaviside mutual inductance bridge
- Campbell bridge
- Carey Foster bridge- Heydweiller bridge

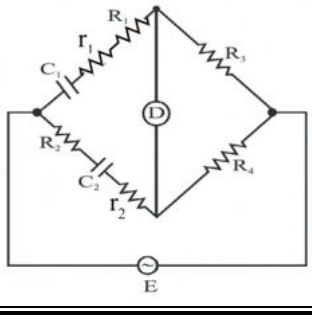
■ Measurement of capacitance-

1. De-Sauty's bridge-

i. For Loss Less Capacitors

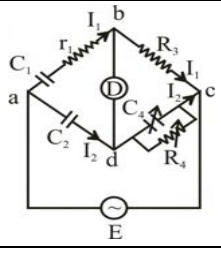
Circuit Diagram	
Formula	$C_1 = \frac{R_4}{R_3} C_2$

➢ **For Lossy Capacitors**

Circuit	

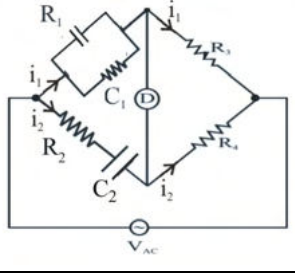
Formula	$r_1 = (R_2 + r_2)\left(\frac{R_3}{R_4}\right) - R_1$ $C_1 = \frac{R_4}{R_3}.C_2$

2. Schering Bridge

Circuit	
Formula	$r_1 = \frac{C_4}{C_2}R_3 \qquad C_1 = \frac{R_4}{R_3}C_2$ $D = \tan\delta_1 = \omega C_1 r_1 = \omega C_4 R_4$
Use	• Use for measurement of relative permittivity and power factor of dielectric materials. • Schering bridge method is used for the measurement of dissipation factor and capacitance
Precaution	Earthed screen are provide to reduce inter- arm capacitance.

■ Measurement of Frequency-

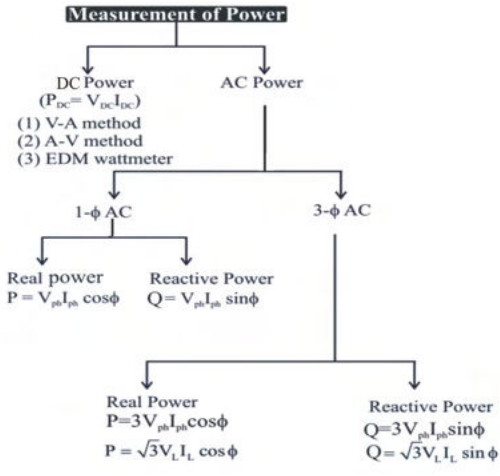
i. Wien's Bridge-

Circuit Diagram	
Formula	$f = \frac{1}{2\pi\sqrt{R_1R_2C_1C_2}}$ If $C_1 = C_2 = C$, $R_1 = R_2 = R$ $f = \frac{1}{2\pi RC}$
Disadvantage	High sensitive with respect to harmonics

• Source of Error in Bridge Circuit

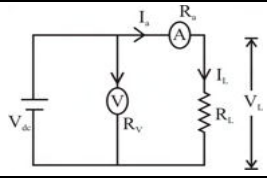
(i) Stray conductance effect
(ii) Mutual inductance effect
(iii) Stray capacitance effect
(iv) Residuals in components

- **Wagner Earthing Device**
- Eliminate the effect of earth capacitors

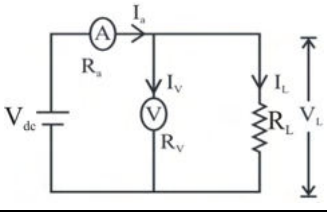


■ DC Power Measurement

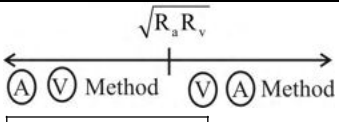
1. V - A method-

Circuit Diagram	
Formula	$P_m = P_T + I_a^2 R_a$ $\quad$ $P_T = I_a^2 R_L$ $\text{Error} = +\text{Ve} \Rightarrow P_m - P_T$ $\downarrow \% \text{ Error} = \frac{P_m - P_T}{P_T} \times 100 = \frac{R_a}{R_L \uparrow} \times 100$
Use	Best for high resistive load

2. A-V method-

Circuit	
Formula	$P_m = P_T + \frac{V_L^2}{R_V}$ $\text{Error} = +\text{ve} \Rightarrow P_m > P_T$ $\% \text{ Error} \downarrow = \frac{I_V}{I_L \uparrow} \times 100$ $\% \text{ Error} \downarrow = \frac{R_L \downarrow}{R_V} \times 100$ $\% \text{ Error} = \frac{P_m - P_T}{P_T} \times 100$
Used	Best for low resistive load.

- **Condition For Equal Error in Both Condition-**



$$R_a = \left(\frac{V_L}{I_L}\right)^2 \times \frac{1}{R_V}$$

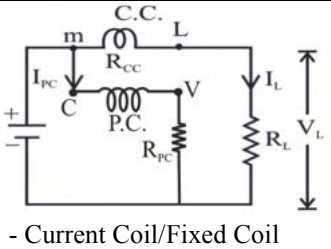
$$R_L = \sqrt{R_a R_v}$$

■ AC Wattmeter-

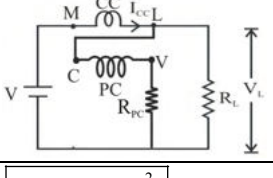
- Electro dynamometer type wattmeter
- Electrostatic wattmeter - Precision or Laboratory type
- Inductance type wattmeter- Only AC power measurement
- Thermocouple wattmeter

1. Electrodynamometer Wattmeter-

a. Connection (1) M-C Short Circuit-

Circuit Diagram	 C.C. - Current Coil/Fixed Coil P.C. - Pressure Coil/Moving Coil R_{CC} - Resistance of Current Coil R_{PC} - Resistance of Pressure Coil
Formula	$P_m = P_T + I_L^2 R_{CC}$, $I_{CC} = I_L$
Error	Due to power loss in current coil.

b. Connection (2) L-C Short Connection-

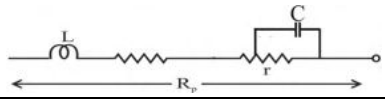
Circuit Diagram	
Formula	$P_m = P_T + \frac{V_L^2}{R_{PC}}$ $I_{CC} = I_L + I_{PC}$
Result	Current coil/Fixed coil → N ↓,A↑ Voltage coil-N↑,A↓
Error	Due to power losses in pressure coil

■ Error in Electrodynamometer Wattmeter

- Error due to pressure coil inductance.
- Error due to pressure coil capacitance.
- Error due to method of connection.
- Stray magnetic field error
- Error due to moving system
- Temperature error

• Error due to Pressure Coil Inductance-

Correction Factor	$\text{Correction factor} = \frac{\cos\phi}{\cos\beta\cos(\phi \pm \beta)}$ -ve → Lagging load +ve → Leading load

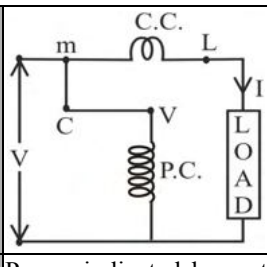
Compensation	• Bifilar winding • Connect a capacitor in parallel with resistance of the value of, $C = \frac{L}{r^2}$ 

- **Error due to Pressure Coil Capacitance-**

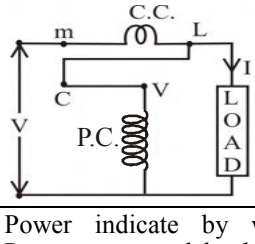
Source	This capacitance is due to, inter-turn capacitance of the series resistance.
Effect	Due to this capacitance the wattmeter reads high on lagging power factor of the load.
Compensation	To eliminate these error $X_L = X_C$ of the pressure coil.

- **Error Because of Connection**

i. M-C Short Connection-

Connection	
Reading	Power indicated by wattmeter = Power consumed and power losses by load + Power consumed in current coil
Prefer	When load current is small

ii. L-C Short Connection

Connection	
Reading	Power indicate by wattmeter = Power consumed by load + Power loss in P.C.
Prefer	When load current is large

- **Low Power Factor Electrodynamometer type Wattmeter-**

These are modification of the Electrodynamometer type wattmeter for reading of low power factor wattmeter.

■ Power measurement in Polyphase System

- **Blondel's Theorem**

(i) For 'n' phase n wire system (n – 1) wattmeter requires (Balance/unbalance)

(ii) For n phase (n + 1) wire system n wattmeter requires (unbalance)

(iii) For n phase (n + 1) wire balance system 1 wattmeter require

■ Measurement of Power in 3-ϕ Circuit

- **Two-Wattmeter Method-**

For inductive load	$W_1 = V_L I_L \cos(30^0 - \phi)$ $W_2 = V_L I_L \cos(30^0 + \phi)$ $W = W_1 + W_2 = \sqrt{3} V_L I_L \cos\phi$
For capacitive load	$W_1 = V_L I_L \cos(30^0 + \phi)$ $W_2 = V_L I_L \cos(30^0 - \phi)$ $W = W_1 + W_2 = \sqrt{3} V_L I_L \cos\phi$

- **Measurement of 3-ϕ Reactive Power-**

$W_1 - W_2 = V_L I_L \sin\phi$

$Q = \sqrt{3}(W_1 - W_2)$

$Q = \sqrt{3} V_L I_L \sin\phi$

- **Reading of two Wattmeter (Load is lagging) :-**

ϕ	cosϕ	Relation between W_1 & W_2
0º	1 (UPF)	$W_1 = W_2$
30º	0.866 lag	$W_1 = 2W_2$
60º	0.5 lag	W_1 = reads, $W_2 = 0$
0º < ϕ < 60º	0.5< cos ϕ < 1	W_1 = +ve, W_2 = +ve
90º	0	$W_1 = -W_2$
60º< ϕ < 90º	0 < cosϕ < 0.5	W_1 = +ve W_2 = –ve

NOTE

At zero power factor, the readings of the two wattmeter are equal but of opposite sign. When the power factor is below 0.5, one of the wattmeter will give negative indication. Under these conditions in order to read the wattmeter, we must either reverse the current coil or the pressure coil connection.

The wattmeter will give a positive reading but this must be taken as negative for calculation of the total power.

■ Measurement of Reactive Power

i. Single Phase VAR meter:-

This is an electrodynamic wattmeter in which pressure coil circuit has a large inductance which is substituted for the series resistance so that the pressure coil current is in quadrature with the voltage.

VI cos (90-ϕ) = VI sin ϕ

ii. Poly-Phase VAR meters

For balanced load- Use a single wattmeter

Current coil → Connected in one line

Pressure coil → Connected across the other two line

■ Measurement of Energy-

- Energy = Power × time, $E = \int_0^t P\, dt$
- Unit → Kilowatt hours or Watt – second or Joule

- Energy meter is used to measure the energy consumed by load.

- **Energy meter**
  - Integrating type instrument
  - Principle based on induction
  - No controlling torque

- **Single Phase Induction Type Watt Hour Meter**

Driving system	Uses two electromagnet, shunt and series coil
Moving system	It consists of an aluminium disc mounted on a light alloy shaft
Braking system	A permanent magnet positioned near the edge of the aluminium disc forms the braking system.
Registering (Counting mechanism)	A train of reduction gears the pinion on the rotor Aluminium disc forms the braking system

- **Braking Torque (T_b)**

➢ Speed of disc $\propto$ power consumed by the load

$$\boxed{T_b = \frac{k\phi^2 Nx}{R}}$$

Where,
R = Resistance of Al disc
ϕ = Flux of permanent magnet
x = Distance of Al disc from permanent magnet
N= Speed of Al disc in (rpm)

NOTE

If the load is constant
Power = Constant then,
$T_d = T_b$= Constant

➢ Due to heat $\left(I_e^2 R\right)$, temp $\uparrow (\alpha = +ve)$

$$R\uparrow, \frac{N}{R} \propto \text{Constant}, \quad \Rightarrow \uparrow N \propto R\uparrow$$

➢ If $x\uparrow$ $Nx = \text{Constant}, N\downarrow$

➢ $\phi\uparrow, \downarrow N \propto \frac{1}{\phi^2\uparrow}$

$\phi \to \infty, N \to 0$

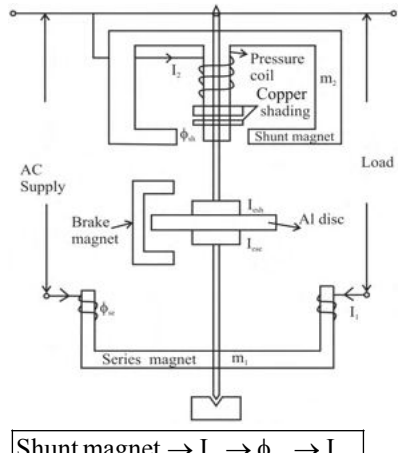
- **Registering System**

➢ Used to directly note the energy in kWh.
Meter constant (K),

$$K = \frac{\text{Rotation made by A}\ell\text{ disc(revolution)}}{\text{Energy consumed by the consumer(kWh)}}$$

- **Construction**

Circuit



$$\text{Shunt magnet} \to I_2 \to \phi_{sh} \to I_{esh}$$
$$\text{Series magnet} \to I_1 \to \phi_{se} \to I_{ese}$$

Pressure coil	• Highly inductive • Connected across the supply
Reading	**Case I:** Series coil resistance = 0 Shunt coil assumed to be pure inductive $\overline{Z}_{sh} = 0 + jX_{sh}$ $\beta = \frac{\pi}{2}$ then, $\boxed{T_d \propto P_T}$ no error **Case II:** Shunt coil has resistance $\overline{Z}_{sh} = R_{sh} + jX_{sh}$ $\beta = \tan^{-1}\left(\frac{X_{sh}}{R_{sh}}\right)$ $T_d \propto I_{sh} I_{se} \sin(\beta - \theta)$ Have some error
Cause of error	• Incorrect magnitude of fluxes • Incorrect phase angle • Lack of symmetry in magnetic circuit • Resistance of shunt coil

- **Compensation of 1-ϕ Energy Meter**

Lag compensation	Through lag coil or shading coil
Low load or friction adjustment	By using shading loop
Over friction or Creeping	By providing holes or slots on rotating disc.
Over load compensation	By keeping saturable shunt magnet in series magnet.
Over Voltage Compensation	Provided by increasing the reluctance of the side limbs of the shunt magnet.
Temperature Compensation	Making permanent magnet of "MUTEMP" material
Speed Adjustment	Adjusting the position of break magnet

- **Adjustment-** For correctly read some adjustment-

Primary light load adjustment
Full load unity factor adjustment
Lag adjustment (Low power factor adjustment)
Light load adjustment
Creep adjustment

- **Creeping Error**

Causes	• Over static friction compensation • Over voltage • Excessive lubrications • Vibration • Stray magnetic field
Eliminate	Two holes are drilled on opposite side of the disc By an iron piece
Magnitude	$\% \text{Creeping error} = \frac{\text{Revolution of disc to creeping per hour}}{\text{Revolution of disc due to total load per hour}} \times 100$

- **Percentage Error in Energy Meter**

Percentage error = $$\frac{\frac{N_x}{K_x} - \frac{N_s}{K_s}}{\frac{N_s}{K_s}} \times 100$$

Where,

K_x – Number of revolutions /kWh under test.

K_s – Number of revolution/kWh for the standard.

N_x – Number of revolutions for certain number.

N_s – Number of revolutions for standard.

- **Temperature Compensation**

Effect	Meter runs fast and resistance is too high.
Eliminate	• Using a temperature shunt on the brake magnet special magnetic material such as MUTEMP. • MUTEMP decreases the permeability with the increases in temperature

- **Phantom Loading**

This loading phenomenon comes in the calibration of energy meter, in which the power consumption of current coil get reduced in calibration work. Potential coil → Rated voltage Current coil → Low voltage DC battery

■ Some Special Purpose Instrument

- **Maximum Demand Indicator**

Maximum demand indicator must be designed to record the average power over successive predetermined. These periods may be of 15 to 30 minutes duration.

- **Types :**

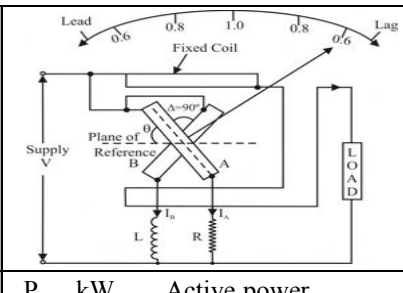
➢ Recording demand indicators

➢ Average demand indicators (Merz price maximum demand indicator)

➢ Thermal type maximum demand indicator

➢ Digital maximum demand indicator

■ Power Factor Meter

Circuit Diagram	
Formula	$\frac{P}{S} = \frac{kW}{kVA} = \frac{\text{Active power}}{\text{Apparent power}}$
Construction	• **Pressure circuit-** It is splitted in two parallel paths. (i) Indicative (ii) Non-inductive • Current circuit • Moving system-balance • Controlling torque-not required
Types	• Electrodynamometer type • Moving iron type

- **Single phase electrodynamometer power factor meter**
  Moving coil- Angle between planes of coil is exactly 90^0
  Designed and calibrated - Only one frequency
- **Three phase Electrodynamometer power factor meter**
  Moving coil- Two moving coils are placed at 120^0
  Designed and calibrated-All frequency.

■ Frequency Meter

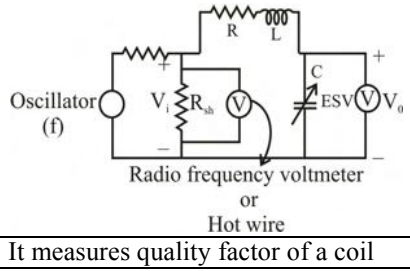
- **Types of Frequency Meter-**

➢ Mechanical resonance type/ Vibrating reed type
➢ Electrical resonance type
➢ Electrodynamometer type
➢ Western type
➢ Ratio meter type
➢ Saturable core type

- **Mechanical Resonance Type (Vibrating reed type)**

Value of reed	4mm wide, $\frac{1}{2}$ mm thick
Arranged	Ascending order
Difference in frequency	$\frac{1}{2}$Hz
Range	7 Hz to 53 Hz
Advantage	Independent of the waveform of the supply voltage.
Disadvantage	Cannot read much closer than half the frequency difference between adjacent reeds.

■ Quality Factor Meter-

Circuit Diagram	
Measure	It measures quality factor of a coil
Principle	It based on series resonance.
Formula	$Q = \frac{\omega L}{R}$
Distributed Capacitance	$\boxed{C_d = \frac{C_1 - n^2 C_2}{n^2 - 1}}$ Where, $f_2 = nf_1$ $f_1 = \frac{1}{2\pi\sqrt{L(C_1 + C_d)}}$ $f_2 = \frac{1}{2\pi\sqrt{L(C_2 + C_d)}}$
Error	• Error due to R_{sh} $\%E = \frac{-R_{sh}}{R + R_{sh}} \times 100$ • Error due to distributed capacitance $\%E = \frac{-(C_d)}{(C + C_d)} \times 100$

Application	• Resistance • Quality factor • Inductance • Bandwidth • Self or Distributed capacitance • Capacitance of a coil

■ Cathode Ray Oscilloscope (CRO)

Principle	Thermoinic emission
Other name	•Electronic voltmeter •Voltage sensitive element
Measure	•RMS, Peak and Average value of signals •By using different modes we can also measures phase, frequency and time period
Mode	(i) y-t mode (ii) x-y mode
Component	• CRT • Vertical amplifier • Horizontal amplifier • Delay line • Triggering circuit • Time base generator

1. CRT (Cathode Ray Tube)

A. Electron Gun

Heating element	Used to heat up the cathode connected with 6.3V, 600 mA supply.
Cathode	Used Ni cylinder with having a coating of BaO or SrO
Control grid	Used to control the number of electron provided with –ve voltage.
Pre-accelerating anode	Used Ni cylinder to accelerate the electron beam and provided with +1500V
Focusing anode	Used to focus the electron beam Electrostatic focusing technique is use.
Post accelerating anode	Used to increase the brightness.

B. Deflecting System

Horizontal deflecting plate	• Deflect the electron beam horizontally • It is placed vertically • It is also known as x-plate
Vertical deflecting plate	• It deflects electron beam vertically • It is placed horizontally and also known as y-plate.
Formula	$Y = \frac{1}{2}\frac{V_d x \ell}{V_a d}$ V_d= Deflecting plate voltage (V) ℓ= Length of plate (m) Y= Electrostatic deflection (m) x= Distance of screen from center of plates V_a= Accelerating potential (V)
Sensitivity	$S_{CRO} = \frac{\Delta Y}{\Delta V_d} = \frac{x\ell}{2V_a d} m/V$

C. Screen-

- The wall of CRT is coated with phosphor.
- The material like silver, manganese, copper and Chromium is added to phosphor material to increase the persistence luminous efficiency.

- **Aquadag-** Aqueous solution of Graphite is used to absorb the secondary emitted electron

2. Time base generator

It generate the saw tooth wave (sweep wave)

$$B.W = \frac{0.35}{t_r}$$

Where, B.W = Bandwidth, t_r = Rise time

3. Oscilloscope Amplifier

- Horizontal amplifier
- Vertical amplifier

4. Delay Line

To match the signal at vertical deflection plate and horizontal deflection plate.

- **Mode of Operation of CRO**

Normal mode	• Measured voltage and current • **x-plate input-** saw tooth signal • **y-plate input-** unknown signal
Dual mode	• Measured frequency, phase difference • **x-plate input-** unknown signal • **y-plate input-** unknown signal

■ Lissajous Pattern-

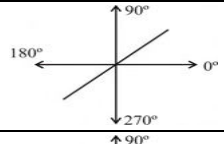
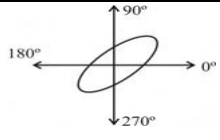
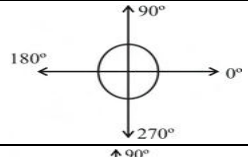
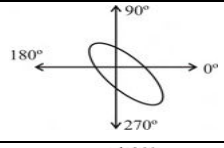
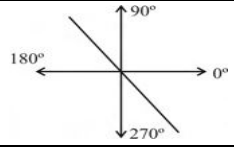
1. Frequency Measurements

$$\frac{f_y}{f_x} = \frac{\text{Max.no.of intersection of a horizontal line with Lissajous pattern}}{\text{Max.no. of intersection of a vertical line with Lissajous pattern}}$$

f_y = Unknown frequency

f_x = Known frequency

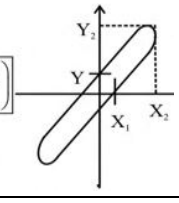
2. Phase Angle Measurement

Phase angle (ϕ) between V_x and V_y	**Lissajous pattern**
0º or 360º Straight line I and III	
0º < ϕ < 90º or 270° < ϕ < 360º Ellipse I & III	
ϕ = 90º or 270º Circle	
90º < ϕ < 180º or 180º < ϕ < 270º Ellipse II & IV	
ϕ = 180º Straight line II & IV	

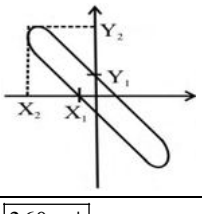
- Lissajous figure from 0º to 180º → Clock wise
- Lissajous figure from 180º to 360º → Anti clock wise

■ Finding the Phase Angle ϕ from given Lissajous Pattern-

a. When lissajous pattern is in 1st and 3rd quadrant-

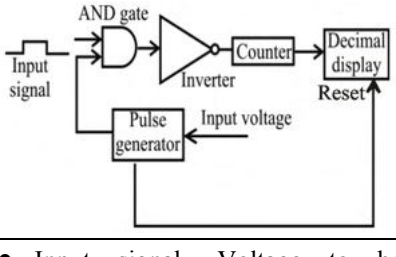
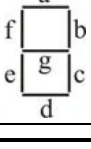
First possibility	$\phi = \sin^{-1}\left(\frac{X_1}{X_2}\right) = \sin^{-1}\left(\frac{Y_1}{Y_2}\right)$ 
Second possibility	$360^0 - \phi$

b. When Lissajous pattern is in second and fourth quadrant –

First possibility	$\phi = 180^o - \sin^{-1}\left(\frac{x_1}{x_2}\right)$ OR $\phi = 180^o - \sin^{-1}\left(\frac{y_1}{y_2}\right)$ 
Second possibility	$360 - \phi$

■ Digital Voltmeter

- It is a voltage sensitive device

Circuit Diagram	
Construction	• Input signal- Voltage to be measured • Pulse generator- To generate rectangular pulse • Width and frequency control- By digital circuit • Amplitude, rise and fall time control-By analog circuit. • Decimal display- Display the value of voltage on LED. 

Input impedance	10 MΩ
Range of resolution	10^{-6} V
Types	• Ramp type digital voltmeter • Integrating type voltmeter • Potentiometric type voltmeter • Successive approximation type • Continuous balance type DVM
Advantage	• High versatile • High accuracy • High resolution • Reduce size • Less power consumption and less cost
Formula	Resolution of DVM $= \frac{1}{10^N}$ N= Number of full digits Sensitivity= resolution × range of meter

- **Dual Slope Integrating DVM**

It is most accurate DVM-

1. $V_m T_1 = V_{ref} . T_2$ **2.** $V_m = \left[\frac{V_{ref}}{10^N}\right] . X$

3. Conversion time = $T_1 + T_2$

4. Design criteria for noise rejection $T_1 = nT_s$

$T_1 = \frac{10^N}{f_{clk}}$, $T_s = \frac{1}{50\ Hz}$

$$\boxed{\frac{10^N}{f_{clk}} = \frac{n}{50Hz}}$$

Where, V_m = Unknown analog voltage signal
V_{ref} = Reference voltage in DVM
T_1=1st Integration time period
T_2 = 2nd Integration time period
T_s = Noise signal time period

■ Instrument Transformer

Instrument Transformers

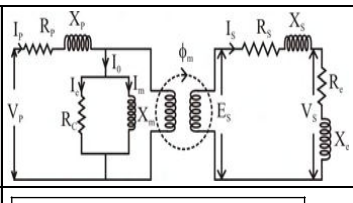
- Current Transformer (C.T.)
  - CT. have been standardized at 5A secondary winding current
- Potential Transformer (P.T.)
  - P.T. have been standardized from 110 to 120 V secondary winding voltage

- **Ratio of Instrument Transformers-**

Transformation ratio (R)	**For C.T.** $R = \frac{\text{Primary winding current}}{\text{Secondary winding current}}$ **For P.T.** $R = \frac{\text{Primary winding voltage}}{\text{Secondary winding voltage}}$

Nominal Ratio (k_n)	**For C.T** $k_n = \frac{\text{Rated primary winding current}}{\text{Rated secondary winding current}}$ **For P.T.** $k_n = \frac{\text{Rated primary winding voltage}}{\text{Rated secondary winding voltage}}$
Turns Ratio (n)	**For C.T.** $n = \frac{\text{No. of turns of secondary winding}}{\text{No.of turns of primary winding}}$ **For P.T.** $n = \frac{\text{No. of turns of primary winding}}{\text{No.of turns of secondary winding}}$
Ratio Correction Factor (RCF)-	$RCF = \frac{\text{Transformation ratio}}{\text{Naminal ratio}} = \frac{R}{k_n}$

- **Burden of an Instrument Transformer-**
  It is convenient to express the load across the secondary winding terminals as the output in volt-ampere at the rated secondary winding voltage.
  It represents in VA unit.
- **Current Transformer-**

Circuit Diagram	
Transformation ratio	$R \simeq n + \frac{(I_m \sin\delta + I_e \cos\delta)}{I_S}$ $R \simeq n + \frac{I_e}{I_S} \simeq n\left(1 + \frac{I_e}{I_P}\right)$ $I_m = I_0 \cos\alpha, \quad I_e = I_0 \sin\alpha$
Phase angle	$\theta \simeq \frac{180}{\pi}\left(\frac{I_m \cos\delta - I_e \sin\delta}{nI_S}\right)$ degree $\theta \simeq \frac{180}{\pi}\frac{I_m}{I_P}$ degree
Ratio error	$\text{Ratio error} = \frac{\text{Nominal ratio}(k_n) - \text{Actual ratio}(R)}{\text{Actual ratio}(R)}$
Characteristics	• Effect of power factor of secondary burden on errors (a) ratio error (b) phase angle • Effect of change of primary current • Effect of change in secondary burden • Effect of change of frequency
Cause of error	• Due to magnetizing current (I_m) • Due to eddy and hysteresis loss • Due to saturation of core • Due to magnetic leakage

Reduction of errors	• Actual transformation ratio has to be close to the nominal ratio • Phase angle is to be small • I_e and I_m must be small as compared to I_p

- CT ratio error is dependent on eddy current loss and magnetizing current.

- In order to minimize errors, the core must have high permeability and low core loss.
- The phase angle error is effected very little by a change of one or two turns in the secondary.
- The secondary winding of the current transformer is always short circuit.
- The primary current of C.T. is depending on the load connected to system but it is does not depends on secondary winding burden.
- The secondary number of turns are reduced by 1 or 2 turns then the ratio error reduces.

■ Potential Transformer

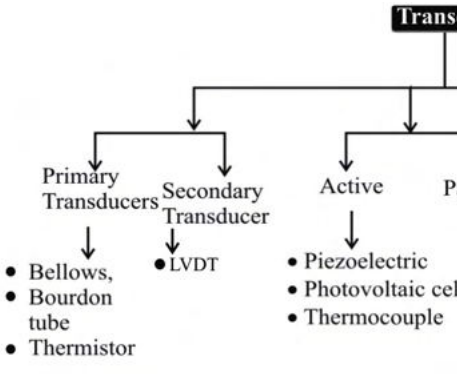
Actual transformation ratio	$R = n + \dfrac{\frac{I_S}{n}\left[R_P \cos\delta + X_P \sin\delta\right] + I_e r_P + I_m X_P}{V_S}$
Phase angle	$\theta = \dfrac{I_S}{V_S}\left(X_S \cos\delta - R_S \sin\delta\right) + \dfrac{I_e X_P - I_m r_P}{nV_S}$ rad.
Characteristics	• Effect of secondary current or VA • Effect of power factor or secondary burden • Effect of frequency • Effect of primary voltage
Cause of error	• Ratio (voltage) error • Phase angle error
Reduction of error	• Reduction of magnetizing and loss component • Reduction of resistance and leakage reactance • Turns compensation

- C.T. never operates with secondary winding open but P.T. can be operated with secondary winding open.
- Strip wound core is used to reduce ratio error and phase angle error.

Application of CT and P.T.

- Multiple operation with a single device
- Measuring circuit is isolated from the power circuit
- Low power consumption
- Replacement is easier

Current Transformer	Potential Transformer
C.T. is used for high current measurement.	P.T. is used for high voltage measurement.
The flux density and exciting current (I_0) of a C.T. varies over a wide range.	The flux density and exciting current (I_0) of a P.T. varies over a restricted range.
Secondary winding of a C.T. should not be open circuited.	The secondary winding of a P.T. can be opened circuited.
A C.T. is equivalent to a series transformer operating under virtual	A P.T. is equivalent to a parallel transformer with its secondary winding operating under open



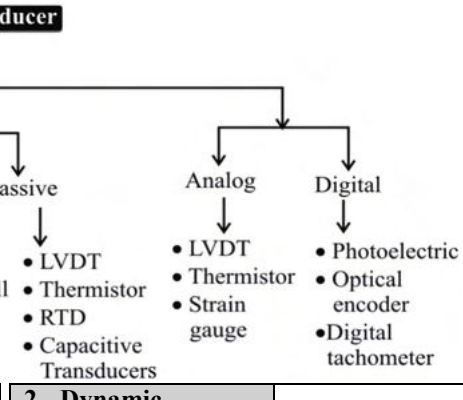
- **Mechanical Primary Transducer Element**

Type	Operation
A. Contacting spindle, pin or finger	Displacement to displacement
B. Elastic Member	
1. Proving ring	Force to displacement
2. Bourdon tube	Pressure to displacement
3. Bellows	Pressure to displacement
4. Diaphragm	Pressure to displacement
5. Spring	Force to displacement
C. Mass	
1. Seismic mass	Forcing function to displacement.
2. Pendulum scale	Force to displacement
3. Manometer	Pressure to displacement.
D. Thermal	
1. Thermocouple	Temperature to electric current.
2. Bimetallic	Temperature to displacement.
3. Thermistor	Temperature to change in resistance
E. Hydropneumatic	
1. Static	
(a) Float	Fluid level to displacement.
(b) Hydrometer	Specific gravity to displacement.

short circuit condition	circuit conditions.
The primary winding current of a C.T. is independent of the secondary winding circuit conditions.	The primary winding current of a P.T. is dependent upon the secondary circuit burdens.
In a C.T. a small voltage exists across its terminals.	In a P.T. a full voltage exists across its terminals.

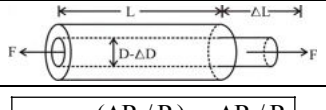
❑ Transducer

- Convert one form of energy into other form of energy
- Also called pickup



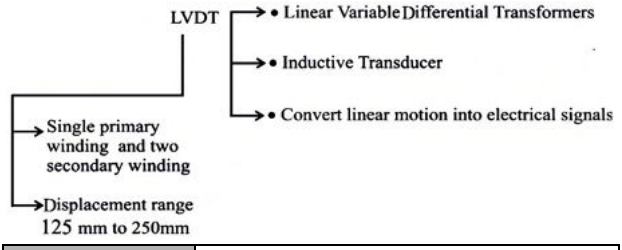
2. Dynamic (a) Orifice (b) Venturi (c) Pitot tube (d) Vanes (e) Turbines	 Velocity to pressure. Velocity to pressure. Velocity to pressure Velocity to force Linear to angular velocity

- **Measurement of Displacement**
- **Strain Gauge-**

Measure	**Force to displacement**
Other name	**Piezo-resistive gauge**
Circuit Diagram	
Gauge factor	$(G_f) = \frac{(\Delta R/R)}{(\Delta L/L)} = \frac{\Delta R/R}{\varepsilon}$ $\varepsilon = \text{strain} = \frac{\Delta L}{L}$ $G_f = 1 + 2\gamma$
Poisson's ratio (γ)	$\gamma = \frac{\text{Lateral strain}}{\text{Longitudinal strain}} = \frac{-\Delta D/D}{\Delta L/L}$
Value of gauge factor	For metal (1.5 to 1.7) For semiconductor (More than 100)
Types	Bonded strain gauge Un-bonded strain gauge Thin foil strain gauge Thin film strain gauge Semiconductor strain gauge

- **Load cell -** Primary transducer + Strain gauge

■ Linear Variable Differential Transformer (LVDT)



Property	Inductive transducer Passive transducer
Measure	Linear displacement into emf
Construction	Single primary winding and two secondary winding The secondary winding are connected in such a way that, the induced emf cancelled out each other.
Range	±0.01 mm to 25mm
Advantage	High sensitivity and used upto 25 kHz
Disadvantage	Sensitive to stray magnetic field Sensitive to mechanical vibration
Application	Used for primary transducer for the displacement measurement and as secondary transducer for force pressure measurement.

- **Galvanometers**
  Types:
  ➢Tangent galvanometer ➢Astatic galvanometer
  ➢Mirror galvanometer ➢Ballistic galvanometer

■ D'Arsonval Galvanometer-

Measurement	Low current
Deflecting torque	$T_d = BINA = GI$
Controlling torque	$T_C = K\theta_f$
Final steady deflection	$\theta_f = \left(\frac{NBA}{K}\right)I = \left(\frac{G}{K}\right)I$ Where, B = Flux density (Wb/m^2) I = Current through moving coil(A) N = No. of turns in coil $A = \ell.d$ = Area of coil (m^2) G = Displacement constant of galvanometer
Types	• Suspended coil galvanometer • Pivoted coil or Weston galvanometer

- **Piezoelectric Transducer**

Property	It is active transducer and used to displacement acceleration force and pressure
Material	**Natural group-**Quartz and Rochelle salt **Synthetic group-** Barium titanate, potassium dihydrogen phosphate

Formula	Charge Sensitivity, $\boxed{d = \frac{Q}{F}}$ (C / N) Voltage Sensitivity, $\boxed{g = \frac{E}{P}}$ (V – m / N) Output Voltage $\boxed{E_0 = gtp}$ Q = Charge t = Thickness of crystal E = Electric field intensity P = Pressure applied
Advantage	• Self generating transducer • Good frequency response upto 20 kHz
Disadvantage	• Output voltage effect due to temperature variation.

- **Measurement of Temperature**

Transducer	**Measurement range (in ^oC)**
Resistance thermometer (RTD)	upto 600^oC
Thermocouple	upto 1400^oC
Thermistors	-100^0C to 300^oC
Pyrometer	1200^0C to 3500^oC
Bimetallic strip	Room temp. (27^oC)

1. Resistance Temperature Detector (RTD)

Principle	Change in resistance in heating element
Range	– 200^oC to 650^oC
Formula	$\Delta R = \alpha \Delta T R_1$
Material	
Advantage	• Fast response, small size and low temperature. • Compensation is not required
Disadvantage	• Bridge circuit needs a power supply. • Cost is high.

Material	**Temp.range**	**Accuracy**
Platinum	upto 538^oC	$\pm 0.5^oC$
Copper	upto 150^oC	$\pm 0.2^oC$
Nickel	upto 316^oC	$\pm 0.2^oC$

2. Thermocouple

Principle	• Seebeck effect • It is an active transducer
Range	-270^oC to 2800^oC
Formula	$e = A\Delta T + B(\Delta T)^2$

ISA type designation	**+ve metal**	**–ve metal**	**Temperature Range**
T	Copper	Constantan	–250ºC to 400ºC
J	Iron	Constantan	–200ºC to +850ºC
B	Platinum Rhodium	Platinum	0 ^oC to 1400ºC
E	Chromel	Constantan	–196 ^oC to 999 ºC
K	Chromel	Alumel	–190 ^oC to 1371 ºC
Y	Iron	Constantan	–129 ^oC to 982 ºC

3. Thermistors

Property	• Negative temperature coefficient • **Temperature range-**100^0C to 300^0C • **Resistance range –** 0.5Ω to 0.75 MΩ • **Thermistors -** Thermal + Resistance
Formula	$R_{T_1} = R_{T_2}\exp\left[\beta\left(\frac{1}{T_1}-\frac{1}{T_2}\right)\right]$

Note :

I. Sensitivity- $S_{thermistor} > S_{RTD} > S_{thermocouple}$
II. Linearity- RTD>Thermocouple>Thermistor

■ Measurement of Pressure

Gauge	Pressure range (mm of Hg)
Low pressure measurement	
• Pirani gauge	10^{-1} to 10^{-3}
• Thermocouple vacuum gauge	upto 10^{-2}
• Mcleod gauge	$<10^{-4}$
• Thermistor vacuum gauge	2.6×10^{-3} to 1.3×10^{-2}
• Ionization type vacuum gauge	10^{-3} to 10^{-8}
High pressure Bridgman gauge	10^5ATM

- **Mechanical gauge for low pressure**
  - ➢ Bourdon tube ➢ Bellow ➢ Diaphragms
- **Data acquisition system**
  - ➢ It is a information system that collects, stores and distributes information.
  - ➢ Data acquisition system are used to measures and record analog signals in basically to different ways.
    - (i) Signal which originate from direct measurement of electrical quantities
    - (ii) Signal which originate from use of transducer
- **Data acquisition system (Signal conditioning)-**

Amplification Filtering Linearization	➢ Isolation ➢ Excitation

- **Types of Instrumentation Systems-**
- **Analog data acquisition system**

Measurement	The system deals with information in analog form
Components	1. Transducer 2. Signal conditioning equipment 3. Calibrating equipment 4. Integrating equipment 5. Visual display device 6. Analog recorders 7. Analog computers 8. High speed cameras and TV equipment
Use	When wide frequency width required are when lower accuracies can be tolerated.

- **Digital Data Acquisition System-**

Measure	A digital quantity make consists of a number of discrete or discontinuous form.

Component	1. Transducer 2. Signal conditioning equipment 3. Multiplexer 4. Signal converter 5. Auxiliary equipment 6. Digital recorder 7. Digital printer
Use	When the physical quantities being monitor has a narrow bandwidth, high accuracy and low per channel cost is required.

❑ Telemetry System-

Telemetry is the indicating recording or integrating of a quantity at distance by electrical means. This may be voltage, current, position, frequency and pulse.

■ Classification of Telemetry System-

IEEE designation	Short distance	Long distance	Analog	Digital
Voltage	Yes	No	Yes	No
Current	Yes	No	Yes	No
Position	Yes	No	Yes	No
Frequency	Yes	Yes	Yes	No
Pulse	Yes	Yes	Yes	Yes

■ **Measurement of Speed -**

In industrial processes, a variable speed refers to the srevolutions per minute of some piece of rotating equipment. There are various methods of measurement like tachometers are the most frequently used device.

- **There are the different types of electrical tachometers :**

➢ Eddy - current or magnetic drag-type tachometers.
➢ Electric generator tachometers, either a.c. or d.c.
➢ Contactless tachometers.
➢ Frequency tachometers.
➢ Ignition-type tachometers.
➢ Stroboscopic tachometers.

■ **Tachometer Generators -**

The tachometer generator is an electromechanical device which generates a voltage output proportional to shaft speed.

- **Types :**

(i) A.C. Tachometer
(ii) D.C. Tachometer

- **Contact less Tachometer (magnetic pickup sensors)-**

➢ This type of tachometer produces pulses from a rotating shaft without any mechanical contact.

Output frequency (f) = $\frac{\text{rpm} \times \text{No.of gear teeth}}{60}$

Range - 0 to 25 rpm to 0 to 72000 rpm

Accuracy - $\pm\frac{1}{2}$% full scale

Reproducibility = 0.2% full scale.

EXAM POINTS

- Indicating instruments should be– **Under damped**
- The type of instruments used mainly for standardizing instruments in laboratories is– **Absolute instrument**
- Pressure gauge Instrument is a ..... **Secondary Instrument**
- Tangent Galvanometer instruments is a– **Absolute instrument**
- The difference between the measured value and the true value of a measured quantity is called- **Static error**
- The type of secondary measuring instruments is - **Ampere-hour meter**
- Radio frequency can be measured by– **Heterodoxy frequency meter**
- Errors that occur after taking care of all gross and systematic errors are called as– **Random errors**
- Error detector is also called as– **Comparator**
- The ratio of output change for a given measuring system is referred to as– **Sensitivity**
- ..... constitutes the most important specification of an instrument– **Range**
- Repeatability and Reproducibility are related to– **Precision of the instrument**
- A set of readings has a wide range and therefore it has– **Low precision**
- In order to achieve accuracy, how should the slide wire of a potentiometer be– **As long as possible**
- Instruments having.....are primarily responsible for loading effect– **Low sensitivity**
- ..... instrument is the cheapest disregarding the accuracy– **Moving iron**
- Errors which may be variable both in magnitude and nature (positive or negative) are classified as ..... error.– **Random**
- Bolometer is used to measure – **Thermal radiation**
- Changes in atmospheric temperature, humidity etc. cause ..... errors– **Environmental**
- The ratio of maximum displacement deviation to full scale deviation of the instrument is called–**Linearity**
- The voltage across an impedance is measured by a voltmeter having input impedance comparable with the impedance causing an error in the reading. This error is known as– **Loading effect error**
- The errors introduced by an instrument fall in ..... category– **Systematic errors**
- …….. instrument is free from hysteresis and eddy current errors– **Electrostatic**
- Swamping resistance is used to compensate error due to– **Temperature variations**
- Instruments can be used both for AC and DC– **Moving-Iron type**
- High torque to weight ratio in an analog indicating instrument indicates- **Low friction loss**
- The unit of mass is- **Kilogram**
- A moving coil instrument can be used to measure- **Direct current only**

- The ratio of the output signal of the given instrument to change the input or the variable under measurement is- **Sensitivity**
- A moving iron ammeter has few turns of thick wire so that - **Resistance became low**
- The gravity controlled instrument must be used in .....position. **Vertical**
- The damping used in a permanent magnet moving coil instrument is - **Eddy current damping**
- The instrument used only in D.C. measurement is..... **PMMC type Instrument**
- In measuring instruments, under equilibrium condition, controlling torque (T_c) and deflecting torque (T_d) are– **$T_c = T_d$**
- The pointer of an indicating instrument is made of– **Aluminium**
- ..... decides the time of response of an indicating instrument– **Damping system**
- ..... is not essential for the working of an indicating instrument– **Braking torque**
- ..... type instruments have hysteresis loss zero– **Moving coil**
- Scale of Moving Iron instruments is– **Non uniform**
- In measuring instruments, damping force can be produced by– **Eddy current**
- Moving iron type meter has nonlinear scale as– **$\theta \propto I^2_{rms}$**
- ..... represents the departure of the observed reading from the arithmetic mean of the group of readings– **Deviation**
- A PMMC meter can be used as an ammeter using– **Shunt resistors**
- In moving coil instruments, the..... scale is used– **Linear**
- In..... instruments the deflecting torque depends on the frequency– **Induction type**
- Energy savings potential of variable torque applications compared to constant torque application is– **Higher**
- If a galvanometer is sensitive, it will provide large deflection on providing– **Small current**
- If current through the operating coil of a moving iron instrument is doubled, the operating force becomes– **4 times**
- An induction meter can handle current up to– **100 A**
- Moving coil (PMMC) and moving iron instruments can be distinguished by observing its– **Scale**
- The scale of moving iron (M.I) instrument is– **Cramped**
- The class of measuring instrument that used for industrial and panel board application is– **Class 1**
- If the damping factor of a system is 1 the system is– **Critically damped**
- A recording type of instrument is – **ECG**
- The instrument is precise if the reading– **Is repeatable**
- Thermal zero-shift in an instrument refers to– **Maximum variation in pen zero due to temperature variation**
- .....does the pointer indicate most accurately– **In about middle of the scale**

- An instrument transformer is used to extend the range of– **Induction instrument**
- Materials used in the fabrication of swamping resistance of PMMC instrument is – **Maganin**
- The degree to which an instrument indicates the changes in measured variable without dynamic error is– **Fidelity**
- The ratio error in current transformer is due to– **Exciting current**
- The 'burden' of current transformer is expressed in- **Volt ampere**
- In an Instrument transformer the errors can be reduced by– **Using low reluctance core**
- A voltmeter has a scale from –15V to 5V. Its span is- **20V**
- The material is used to make a shunt– **Manganin**
- The measuring instrument ..... has least value of internal resistance– **Ammeter**
- Ammeter and voltmeter are connected across the load in …… and ……. respectively– **Series, parallel**
- A generating voltmeter uses– **A constant speed motor**
- .....Provide deflecting force for voltmeters only– **Electrostatic effect**
- ..... instrument is used to detect the small electric current– **Galvanometer**
- Electrostatic type devices are mainly used as…..... **Voltmeter**
- Voltmeter has– **High resistance**
- Voltmeter may be a galvanometer with– **High resistance**
- A bulb-type voltage tester is recommended only for circuits at or under ..... volts– **120 volts**
- The advantage of using a dual slope ADC in a digital voltmeter is that– **Its accuracy is high**
- Ammeters are always connected in– **Series**
- The Energy provided by Ideal voltage source is .....when the Load is Open circuit– **Zero**
- The resistance of a voltmeter and Ammeter is respectively– **High and Low**
- ..... is used to measure direct current– **Ammeter**
- The voltage of a circuit is measured by a voltmeter whose input impedance is low as compared to the output impedance of the circuit. The error caused will be due to– **Loading effect**
- The frequency error in induction type ammeter is compensated by– **Non inductive shunt**
- The calibration of a voltmeter can be carried out by using– **A potentiometer**
- Instrument needed both for protection and metering– **Instrument transformer**
- A voltmeter using thermocouple measures– **RMS value**
- In an induction type meter, maximum torque is produced when the phase angle between two fluxes is– **90°**
- ..... does have a deflecting torque governed by frequency– **Induction type instrument**
- If torque/weight ratio of an instrument is low, then– **The sensitivity of the meter is low**

- ..... elements are added with moving iron ammeter for its compensation against frequency errors– **Shunt capacitance**
- A repulsion type voltmeter when used in A.C. circuits indicates– **R.M.S. value**
- In an attraction type instrument, the operating force is approximately proportional to– **Square of the current**
- When AC voltage is applied to a PMMC meter, then– **The reading is zero**
- In an ammeter the shunt resistance is usually ..... resistance– **Less than**
- The instruments may be used to measure D.C. voltage accurately– **Moving coil type instrument**
- A high resistance is usually connected in series with an electrostatic voltmeter– **For safety reasons**
- A moving iron type ammeter has few turns of thick wire so that– **Resistance is less**
- Instruments used for measuring 132 kV A.C. voltage is – **Electrostatic voltmeter**
- The multiplier and the meter coil in a voltmeter are in– **Series**
- The scale of a rectifier instrument is– **Linear**
- Electrostatic voltmeters are particularly for measuring high voltage because the construction is simplified due to– **Small value of current**
- Instruments commonly used to measure primary current of a transformer connected to mains is – **Moving iron meter**
- The primary emf is least affected by the secondary terminal conditions in a– **Current transformer**
- Clamp-on ammeter used for measurement of – **High ac current**
- Rectifier type instrument can be used in– **A.C. AND D.C.**
- Dynamometer type of instrument can be used in– **Both A.C. and D.C.**
- The full scale deflection in an Induction instruments is about– **300^0**
- Electro dynamometers are used extensively for the measurement of– **Power**
- .....is used to measure high values of alternating current with a dynamometer– **Current transformer**
- The scale of an electrodynamometer usually reads the– **Effective value of the ac**
- The fixed coil in a dynamometer wattmeter is the– **Current coil**
- The Dynamometer type wattmeter can be used to measure- **AC or DC power**
- The wattmeter measures - **Real power**
- A dynamometer type instrument is chiefly used as a- **Wattmeter**
- For the 2-wattmeter method shown in the figure, which is a common terminal to both the pressure coils- B
- Polyphase wattmeters are made by attaching .....electrodynamometer movements- 2
- You are extending the range of a wattmeter. How will you connect the primary of the potential transformer- **Parallel to the line**

- What is the angle between (in degrees) the planes of two moving coils of a dynamometer type 3-phase power factor meter– **120º**
- Pointing-vector Wattmeter works on– **Hall effect**
- In dynamometer type of wattmeter, which type of coil is split up into two parts– **Current coil**

Much less than 60 W

- Which type of Wattmeter is widely used–

Dynamometer type

- Damping generally used in dynamometer type Wattmeter– **Air friction damping**
- The main error in dynamometer type wattmeter is due to– **Pressure coil inductance**
- The resistance in the circuit of the moving coil of a dynamometer wattmeter should be– **High**
- The minimum number of wattmeters required to measure power in an unbalanced three wire system is– **Two**
- Electrodynamic type of instruments are commonly used for the measurement of– **Power**
- The instrument used for the measurement of power at 500 MHz is– **Bolometer**
- The readings of a dynamometer type wattmeter can be highly erratic at– **Low power factor**
- How will you test the supply in plug point–

Tester, multimeter, voltmeter

- Moire fringes are used to measure rotary displacement along with– **Optical encoders only**
- Energy meters instrument is– **Integrating type**
- A domestic energy meter disc moves slowly, even when main switch is off the reason is- **Creeping error**
- Creeping is the phenomenon which occurs in -

Energy meter

- Alternating current is measured by–

Induction ammeter

- Watt-hour instrument is a type of– **Integrating**
- an energy meter is made up of a few turns of thick wire connected in series with the load?- **Current coil**
- To measure ..... Integrating meter is used–

Energy

- To minimize the loading effect of circuit under test, the input impedance of the device must–

Be very high

- Household energy meter falls under category of which type of instrument–

An integrating instrument

- An Integrating instrument is called by –

Watt–hour meter

- The series magnet of a single phase Energy meter consists of coil of– **Thick wire of few turns**
- In an energy-meter which coil carries the current proportional to supply voltage– **Pressure coil**
- instruments, a disc is present– **Energy meter**
- The creeping is observed in– **Energy meter**
- The disc of domestic supply energy meter is made of– **Aluminium**
- In a single phase induction type energy meter, the deflecting torque is——— the true power in the circuit– **Proportional to**
- The pressure coil of an induction type energy meter is– **Highly inductive**

- In order to reduce the loading effect of the circuit under test, the input impedance of an electronic meter should be– **High**
- The adjustment of position of shading bands, in an energy meter is done to provide– **Friction compensation**
- The chemical effect of current is used in– **D.C. ammeter hour meter**
- The household energy meter is– **An integrating instrument**
- Induction type single phase energy meters measure electric energy in– **KWh**
- For controlling the vibration of the disc of an AC energy meter, damping torque is produced by– **Eddy current**
- Instrument used to make an ohmmeter is – **Moving coil type**
- A voltmeter using thermocouple measures– **RMS value**
- To avoid the effect of stray magnetic field in ac bridge we can use– **Magnetic screening**
- Wagner earthing device is used to eliminate error due to– **Electrostatic coupling**
- Megger is a combination of – **Generator and Ohmmeter**
- Bridge circuits work on the _____. **Null indication principle**
- A megger is exclusively designed for measuring– **Very high resistance**
- The principle of operation of hot-wire instrument is- **Thermal effect**
- AC bridge is balanced, then the current through the detector is equal to- **0 Amp.**
- The total number of arms and the total number of balance detectors in an AC bridge, respectively, are-**4, 1**
- Which method is used to measure the resistance in the range of 1Ω to 100 kΩ?- **Ammeter-Voltmeter method**
- So as to eliminate the effect of lead and contact resistances while measuring low valued resistances, the _____ is used. **Kelvin double bridge**
- If kelvin Bridge has three known resistance x, 2x and 4x respectively. The value of unknown resistance is - **2x**
- In a meggar controlling torque is provided by– **Coil**
- An earth tester is a special type of megger with some additional constructional features these features are- **Rotating current reverser and rectifier**
- bridge is used to measure the capacitance and equivalent series resistance of a capacitor– **Schering bridge**
- A device is used to measure the insulation resistance without damaging the insulation– **Megger**
- Low resistance is measured by– **Kelvin's double bridge**
- The scale of a megger is generally ranges from– **(0 – ∞) Ω**
- When checked with an ohm meter an open resistance reads– **Infinite**

- Q- Meter works on the principle of- **Series Resonance**
- Low resistance value can be measured accurately by using- **Kelvin double bridge**
- The bridge that is used to measure the resistance of motor winding is- **Wheatstone bridge**
- When checked with an ohm meter an open resistor reads– **Infinite ohm**
- Wheatstone bridge is used to measure– **Resistance**
- Q meter works on principle of– **Series resonance**
- The most commonly used method for the measurement of high resistance is- **Megger method**
- Bridges used to measure capacitance is- **Schering bridge**
- bridges is used to measure dielectric loss of capacitor - **Schering bridge**
- The reading of Megger, if the measuring terminals are open circuited is- **Infinity**
- Inductance is measured by **-** **Maxwell bridge**
- Loss of charge method is used to measure - **High resistance**
- More suitable to measure the perfect capacitor is- **De-Sautys bridge**
- Bridge most suitable for the measurement of an unknown capacitance is– **Schering Bridge**
- Anderson Bridge is used for the measurement of an unknown– **Inductance**
- De Sauty's Bridge is most suitable for the measurement of– **Capacitance**
- To measure dielectric loss you would use– **Schering bridge**
- Element used to provide inductance in a circuit is– **Choke**
- The bridge widely used for capacitance and dissipation factor measurements is– **High Voltage Schering bridge**
- Megger is commonly used to measure-– **High resistance**
- AC Bridges cannot be used for the direct measurement of– **Capacitance**
- The accuracy of null type instruments is generally .....Deflection type instruments– **Greater**
- Wheatstone bridge is balanced, the galvanometer reads– **Zero current**
- Type of a bridge circuit used to measure inductance and capacitance is – **AC bridge**
- The devices can be used to test the windings of an inductor for continuity– **Ohmmeter**
- The resistivity of the wire material can be expressed in terms of LMTI system of dimensional parameter as– **$[ML^3 T^{-3} I^{-2}]$**
- Devices may be used to measure accurately the inter-electrode capacitancesc is– **Schering's bridge**
- In A.C. bridge if the supply frequency is 1000 Hz, the detector will be– **Telephone detector**
- The e.m.f. of a Weston standard cell can be measured by– **Potentiometer**
- Value of the resistance is shown by a needle in a megger when not in operation– **Infinity**
- For measurement of inductance having high value, we should use– **Hay's bridge**
- If the current in a capacitor leads the voltage by 80^0, the loss angle of the capacitor is– **10^0**

- In a Schering bridge the potential of the detector above earth potential is– **A few volts only**
- To avoid the effect of stray magnetic field in A.C. bridges we can use– **Magnetic screening**
- The criterion not used to select potentiometer in a control system– **Noise**
- Inductance of a coil having Q value in the range of (1 < Q < 10) can be measured by using– **Maxwell bridge**
- Vibration galvanometer, tunable amplifiers and head phones are used in– **AC bridges**
- In magnetic measurements, Lloyd-Fisher square is used to determined– **Iron losses**
- Illumination is measured using– **Luxmeter**
- High resistances are provided with a guard terminal in order to– **Bypass the leakage current**
- When a steady current is passed through a ballistic galvanometer, then the conduction will be– **Zero**
- For a sensitive galvanometer, the type of support used is– **Suspension**
- Resolution of a wire wound potentiometer be improved – **By reducing the diameter of the resistance wire**
- Hot wire instruments have ——— scale- **Square**
- The Guage factor of a Resistance wire strain guage, is a measure of **Sensitivity of gauge**
- In a thermocouple elements, heat energy transferred to the hot junction is converted back to electrical energy by– **Seebeck effect**
- In the Doppler flow meter- **No moving parts**
- For ....., the frequency range is limited by to a maximum of about 5 KHz- **Carbon microphones**
- Seismic transducer may be used in ..... mode- **Displacement**
- ..... type of manometer is best for measuring low pressure- **Inclined Tube**
- In a float type level indicator float is made of – **Stainless steel**
- _____ in an example of a passive transducer that uses the variation in electrical resistance in wires to sense the _____ produced by a force on the wires - **Strain gauge, strain**
- Optical Pyrometer is used to measure– **High Temperature**
- …….is a temperature sensitive resistor whose resistance decreases with increasing temperature - **Thermister**
- A pressure gauge is calibrated between 100 bar and 350 bar. The scale span is– **250 Bar**
- A transducer that converts measurand into the form of pulse is called the _____ transducers – **Digital**
- Capacitive microphone converts sound into ------ output - **Electrical**
- The transducer is used for transmitting as well as receiving the acoustic energy in an ultrasonic flow meter - **Piezoelectric crystal**
- Semi conductor strain gauges depend upon .....for their action– **Piezoresistive effect**
- Transducers may not be called as– **Amplifier**
- LVDT cannot measure is– **Temperature**
- Conveyor-based method is used for the measurement of the flow of– **Solids**
- Tachometer (or Tacheometer) is an instrument for measuring– **RPM**

- Piezo – electric material is – **Quartz**
- The most suitable transducer for monitoring continuously variations in very fine thickness (say of paper in a paper industry)– **LVDT**
- Bonded strain gauge are– **Used for both stress analysis and for construction of transducers**
- Strain gauges are constructed with Germanium chips because Germanium– **Has a piezo electric Property**
- .....transducers measures the pressure by producing emf as a function of its deformation– **Piezoelectric transducer**
- Piezoelectric materials own their property to the– **Lack of a centre of symmetry**
- The piezoelectric crystal voltage sensitivity is defined as– **Field developed per unit stress**
- Piezoelectric crystal is generally employed for the measurement of which – **Acceleration**
- Doppler shift principle is used in the measurement of– **Speed**
- Which quantity can be measured by a hot wire anemometer– **Gas velocity**
- Thermistors have ..... temperature co-efficient– **Negative**
- A dummy bridge employing strain gauge provides– **Temperature compensation**
- Which can be measured with the help of piezo-electric crystal– **Acceleration**
- ..... can measure only pressure– **Belt type meter**
- ..... can measure only level– **Radioactive method**
- By a 'Rotameter' we can measure– **Flow**
- Load cell is essentially a– **Strain gauge**
- ..... can measure pressure directly– **Bourden tube**
- PMMC meter is fitted in– **Multimeter**
- A multimeter can measures- **Voltage, Current, Resistance**
- PMMC meter employed in — **Multimeter**
- For contactless body temperature measurement, advanced thermometer are used. They are based on- **Infrared radiation**
- A type of recording instrument is– **X–Y plotter**
- Element in CRO is used to collect secondary emission electrons is– **Aquadag**
- The main part of a CRO is– **CRT**
- A multimeter uses different multipliers to increase the– **Voltage range**
- In a standard multimeter for measuring AC voltage, parameter of.....voltage is measured– **RMS**
- Circuit conditions does a metal oxide varistor (MOV) protect against is– **High voltage**
- A multimeter is often called a VOM, which is an abbreviation of volt-ohm– **Milliammeter**
- Meter suitable for the measurement of 10 m V at 50 MHz is– **CRO**
- Horizontal deflection plates of CRO are placed generally– **Vertical**
- Lissajous pattern obtained on a CRO screen is a circle. Frequency of two signals are– **Equal**
- the resolution of 4-digit digital instrument is–**0.01%**
- Cathode of CRO is coated with– **Barium oxide**
- A CRO can be used to measure– **AC voltage, DC voltage, Frequency**
- In a $3\frac{1}{2}$ digit voltmeter, the largest number that can be read is– **1999**

- Electronic voltmeters provide more accurate readings in high resistance circuits as compared to non-electronic voltmeters because of their– **High ohm/ V ratings**
- primarily used as resistive temperature sensors and current limiting devices- **Rheostat**
- Chemical effect is utilized in ------- meters **-** **Ampere hour**
- The maximum current rating of an induction meter- **100 A**
- Insulation resistance is measured by– **Megger**
- ..... part/phenomenon controls the controlling torque in megger– **Coil**
- Instrument can measure voltage, resistance, and current– **Multimeter**
- Moire fringes are used to measure rotary displacement along with– **Optical encoders only**
- The operation of a Megger is based on- **Moving coil meter**
- The size of the slide wire of the potentiometer to make it to achieve high accuracy– **As long as possible**
- Instrument is used in AC the current is too high to be handled directly– **Current transformer**
- Continuity of an electrical circuit is usually checked by– **Ohm meter**
- the apparatus used for testing rotor of an induction motor– **Growler**
- A CT supplies current coils of a wattmeter, power factor meter, energy meter and ammeter, the connection is– **All coils in series**
- The standard secondary voltage for a PT is– **120V**
- The errors in CT are mainly due to– **Core loss**
- The working scale of M.I. type P.F. meter is– **90°**
- Megger essentially is a– **Series type ohm meter**
- The number of coils in the megger is– **Two**
- In a series ohm meter, the resistance is to have– **Series with the meter**
- Ballastic galvanometer is calibrated to measure– **Charge**
- Instrument used for the comparison of different source is– **Bunsen meter**
- If an ohm meter reading immediately goes practically to zero and stays there while checking a capacitor, the capacitor is– **Short circuited**
- A ..... is used to measure frequency in wave guides– **Galiometer**
- In brewing process the degree of fermentation is measured by– **pH meter**
- In a Weston frequency meter, the magnetic axis of the two fixed coils are– **Perpendicular**
- In Weston synchronoscope the moving coil is connected across– **Bus-bars**
- In CRT, the secondary electons are collected by a conductive coating aquadag which is made up of– **Graphite solution**
- An Aquading is used in a CRO to collect– **Secondary emmission electrons**
- A vertical for a CRO will be desinged for– **A constant gain times bandwidth product**
- The delay line in CRO is placed after– **Vertical amplifier**
- The frequency range of vibrating reed frequency meter is– **47 Hz to 53 Hz**

PREVIOUS YEA

1. Linear meter with a 1% of full scale accuracy should have _____ on the 1 V range.

(a) 200 divisions (b) 100 divisions
(c) 500 divisions (d) 50 divisions

RRB JE- 01.09.2019

Ans. (b) : Full Scale deflection = 1V

$$\text{Error} = 1 \times \frac{1}{100} = 0.01$$

Linear meter 1 V reading in error 0.01V.

$$\text{Full Scale division} = \frac{1}{\text{resolution}} = \frac{1}{0.01} = 100 \text{ division}$$

2. A 0-25 A ammeter has a guaranteed accuracy of 1 percent of full scale reading. The current measured by this instrument is 10 A. Determine the limiting error in percentage.

(a) 10.100% (b) 7.50%
(c) 2.50% (d) 5.00%

RRB JE 31.08.2019

Ans. (c) : Given-

Full Scale Value= 25 A

Measured Value = 10A

Accuracy = 1%

% Limiting error

$$= \frac{\text{Full Scale deflection} \times \text{Accuracy}(\%)}{\text{Measured Value}}$$

$$= \frac{25 \times 1\%}{10} = 2.5\ \%$$

3. DC probes are generally used with a voltmeter to-

(a) Decrease its range
(b) Increase its range
(c) Frequency independent
(d) None of these

RRB Kolkata JE-25.10.2009

Ans : (a) DC probes are generally used with a voltmeter to decrease its range. Two probes are used together to measure voltage, current, and two-terminal components such as resistors and capacitors. When making DC measurement it is necessary to know which probe is positive and which is negative, so by convention the probes are colored red for positive and black for negative.

4. Ammeter and voltmeter are connected across the load in …… and ……. respectively.

(a) series, parallel (b) parallel, series
(c) series, series (d) parallel, parallel/

RRB Mumbai JE-19.12.2010

Ans. (a) : Ammeter is connected in series with load and voltmeter is connected in parallel with load. The resistance of Ammeter is low and voltmeter is high. Ammeter is used for measuring current and voltmeter is used for measuring voltage.

5. Creep error may occur in induction type energy mater due to

(a) Incorrect position of brake magnet

AR QUESTIONS

(b) Incorrect adjustment of position of shading band
(c) Overvoltage across voltage coil
(d) Increase in temperature

RRB Bangalore SSE-01.02.2009

Ans. (c) : Creeping error generally occurred due to over compensation of friction and it will be also happened due to over voltage across the potential coil.

6. Which instrument is used to detect the small electric current?

(a) Voltmeter (b) Wattmeter
(c) Multimeter (d) Galvanometer

RRB Mumbai SSE-19.12.2010

Ans : (d) To detect the small electric current we can use galvanometer. A galvanometer is an instrument that can detect the presence of a current in the circuit. The pointer remains at zero (the centre of the scale) for zero current flowing through it. It can deflect either to the left or to the right of the zero of zero mark depending on the direction of the current.

7. The type of instruments used mainly for standardizing instruments in laboratories is

(a) Indicating instrument
(b) Integrating instrument
(c) Absolute instrument
(d) Recording instrument

RRB SSE (Shift-III) 02.09.2015

Ans : (c) Absolute instrument given the magnitude of the quantity under measurement in term of physical constants of the instrument. These absolute instrument are standard and are used in laboratories.

8. In a single phase induction type energy meter, the deflecting torque is _____ the true power in the circuit.

(a) proportional to (b) equal to
(c) greater than (d) less than

RRB Bangalore SSE-01.02.2009

Ans. (a) : In a single phase induction type energy meter, the deflecting torque is proportional to the true power in the circuit.

9. The pointer of an indicating instrument should be :

(a) very light (b) very weighty
(c) light (d) weighty

RRB SSE (Shift-I), 03.09.2015
RRB JE Chennai -2014), AAI 26.4.201

Ans : (a) The pointer of an indicating instrument should be very light and made by Aluminium thus torque to weight ratio becomes high by which sensitivity will be high.

10. The use of ..... instruments is merely confined within laboratories as standardizing instruments.

(a) Absolute (b) Indicating
(c) Recording (d) Integrating

RRB SSE (shift-III), 02.09.2015

Ans. (a): The use of absolute instruments is merely confined within laboratories as standardizing instruments.

11. Two meters X and Y required 40 mA and 50 mA respectively for full scale deflection. Then

(a) Both are equally sensitive.
(b) Data are insufficient to comment
(c) X is more sensitive than Y
(d) Y is more sensitive than X

RRB SSE (Shift-II), 03.09.2015
RRB Malda SSE-25.10.2009

Ans: (c) Sensitivity is defined as amount of deflection per unit current-

$$S = \frac{D}{I}$$

$$\because S_X = \frac{1}{40mA} = \frac{1000}{40} = 25\Omega / V$$

$$\because S_Y = \frac{1}{50mA} = \frac{1000}{50} = 20\Omega / V$$

Hence,

from the above solution it is clear that sensitivity of X is more then sensitivity of Y.

12. Moving iron instrument can be used as-

(a) Ammeter
(b) Voltmeter
(c) Wattmeter
(d) Both ammeter and voltmeter

RRB Jammu SSE-09.09.2012

Ans. (d) : For moving iron type instruments, The deflecting torque $\boxed{T_d = \frac{i^2}{2}\frac{dL}{d\theta}}$

And controlling torque $T_c = K.\theta$

- It can be used as Ammeter and voltmeter gives their r.m.s. value.
- Both can work on A.C. as well as on D.C.

13. Which of the following instruments should be used for accurate measurement of low DC voltage ?

(a) Volt meter of small rotate coil
(b) DC potentiometer
(c) Small thermocouple meter
(d) Hot wire voltmeter

(RRB JE Bhopal Paper II (Shift-II), 26.08.2015)

Ans : (b) DC potentiometer should be used for accurate measurements of low dc voltage.

- A DC potentiometer is a potentiometer in which the supply is a battery and the balance is under direct current conditions.
- The DC potentiometer is an instrument used for measuring the unknown voltage by comparing it with the known voltage.
- It can be used to determine the emf and internal resistance of the given cell and also used to compare the emf of different cells.

14. The disc of domestic supply energy meter is made of which material?

(a) Zinc (b) Copper
(c) Aluminium (d) Silver

RRB Bhopal SSE-24.11.2002

Ans. (c) : The disc of the domestic supply energy meter is made of aluminium materials. It measures electrical energy in kilo-watt hour (kWh).

15. The function of measurement system is/are ___.

(a) indicating function
(b) recording function
(c) controlling function
(d) indicating, recording and controlling function

RRB Mumbai JE-05.10.2008

Ans : (d) The functions of measurement system are indicating, recording and controlling. The system which controls deflection in instrument is controlling system. Indicating system indicates the measured quantity with the help of indicator on marked scale at the same time. Recording system, records the value of electrical quantity on a graph paper.

16. The difference between the indicated value and the true value of a quantity is

(a) Gross error (b) Absolute error
(c) Dynamic error (d) Relative error

RRB Mumbai SSE 05.10.2008

Ans. (b) : The difference between the indicated value and true value during any physical quantity measurement is known as absolute error, it is basic definition of absolute error in the contest of measurement.

17. The two types of errors that are related to differentials are-

(a) Human, Absolute
(b) Absolute, Relative
(c) Relative, Controllable
(d) Controllable, Natural

RRB Mumbai SSE-05.10.2008

Ans. (b) Absolute and Relative error are related to differentials error.

18. Which of the following types of errors are dynamic errors?

(a) Instrument errors caused due to slow response of instruments
(b) Environmental errors
(c) Observational errors
(d) Human errors

RRB Mumbai JE 19.12.2010

Ans : (a) As speed of response related to time constant of the system. Hence instrument errors due to slow response are dynamic errors.

19. Copper shading is provided in energy meter to

(a) Bring flux exactly in quadrature with applied voltage
(b) To increase speed of aluminium disc
(c) To count the rotation
(d) To balance the system from vibration

RRB Allahabad JE-25.10.2009

Ans. (a) : An adjustable copper shading rings are provided on the central limb of the shunt magnet to make phase angle displacement between magnetic field set up by shunt magnet and the supply voltage is approximately 90 degree. Thus copper shading is provided in energy meter to bring flux exactly in quadrature with applied voltage

20. The creeping is observed in

(a) Ammeter meter (b) Wattmeter
(c) Energy meter (d) Volt meter

RRB Allahabad JE- 2014

Ans. : (c) Sometimes the energy meter moves slowly in the condition of no load when only the voltage coil of the energy meter is supplied, it is called creeping error. This error in the energy meter is caused by the friction compensation, vibration stray magnetic field or supply voltage exceeding the normal state. To overcome this error, two holes are made at 180° in opposite directions from each other on either side of the spindle in the meter.

21. Torque/Weight ratio of an instrument indicates

(a) Selectivity (b) Accuracy
(c) Fidelity (d) Sensitivity

RRB SSE Secunderabad (Shift-I) 02.09.2015
Konkan Railway STA 2017

Ans. (d) : Torque to weight ratio means high torque produced by light weighted instrument component, it means less torque (less current) required for full deflection that mean high sensitivity. Hence high torque to weight ratio indicate instrument is highly sensitive.

22. Strike out the features not to be associated with the rectifier instruments

(a) Small power loss
(b) High degree of measuring accuracy
(c) High sensitivity
(d) None of these

Konkan Railway SSE-2015

Ans. (d) : There is less power loss in rectified instrument this device has high degree of measurement of accuracy. The sensitivity of this device is high.

23. In an energy-meter which coil carries the current proportional to supply voltage.....

(a) Current coil
(b) Pressure coil
(c) Both pressure and current coil
(d) None of these

RRB Allahabad SSE-09.09.2012

Ans : (b) When the energy meter is connected in the circuits the current coil carries the load current and the pressure coil made of thin wire and more turn.

24. Which one of the following types of instruments does suffer from error due to magnetic hysteresis?

(a) Induction type (b) Electrodynamic
(c) Moving Iron (d) PMMC

RRB Kolkata JE-25.10.2009

Ans: (c) MI instruments suffers from error due to magnetic hysteresis due to moving part in the instrument.

25. Observational error are called:

(a) Gross errors (b) Systematic errors
(c) Random errors (d) Instrumental errors

RRB Chandigarh SSE-25.10.2009

Ans. (b) : Observational error are called systematic errors.

Type of errors:

1. Gross error
2. systematic error-
   (i) Instrument Error
   (ii) Environment Error
   (iii) Observation Error
3. Random Error

26. For accuracy of the instrument which is necessary-

(a) Conformity (b) Precision

(c) Both (d) None of the above

RRB Chandigarh SSE-25.10.2009

Ans : (c) For accuracy of the instrument conformity and precision both are necessary. Measurement of quantity accurately shows the position, quantity and properties. But for whole conformity and precision is necessary for accuracy of the instrument.

27. Household energy meter falls under category of which type of instrument?

(a) a magnetically revolving type instrument

(b) a recording instrument

(c) a displaying instrument

(d) an integrating instrument

RRB Bhopal TM SSE-25.10.2009

Ans. (d) : For the measurement of energy, we use energy meter, Energymeter is an integrating instrument which adds the energy cumulatively over a period of time.

$$E = \int_0^t P.dt \quad kWh$$

28. Which of the following instruments has the highest torque/weight ratio among the given instruments?

(a) Attraction type MI instrument

(b) Repulsion type MI instrument

(c) Permanent magnet moving coil instrument

(d) Electrodynamometer instrument

RRB SSE Secunderabad (Shift-I)-02.09.2015

RRB Mumbai C& G JE-25.10.2009

Ans: (c) A permanent magnet moving coil instruments (PMMC) has highest torque/weight ratio. i.e. highly sensitive.

29. Errors which may be variable both in magnitude and nature (positive or negative) are classified as ..... error.

(a) Hysteresis (b) Random

(c) Interaction (d) Systematic

(RRB SSE Secunderabad Red Paper, 21.12. 2014)

Ans : (b) Random error comes from unpredictable changes during experiments. It may be variable both in magnitude and nature (positive or negative).

30. Which of the following are cost effective instruments?

(a) Active instruments

(b) Former is passive instrument and later is active instrument

(c) Former is active instrument and later is passive instrument

(d) Passive instruments

RRB Allahabad JE-25.10.2009

Ans. (d) : In terms of cost, passive instruments are usually of a simpler construction than assets and, therefore, are cheaper to manufacture. e.g. pressure gauge, voltmeter, ammeter.

31. The damping torque in a moving coil instrument is caused by:

(a) eddy current (b) gravity friction
(c) fluid friction (d) copper losses

DMRC JE 2018, Shift III
DMRC JE 18.02.2017
RRB SSE (Shift-III) 01.09.2015

Ans. (a) : Th0e damping torque in a moving coil instrument is caused by eddy current. A moving coil instrument is operated only on DC and also known as "PMMC instrument". It has high torque to weight ratio. And scale also is uniform and linear. The deflecting torque in a PMMC instrument can be given by-

$$T_d \propto I$$

32. The series magnet of a single phase Energy meter consists of coil of .....

(a) Thin wire of few turns
(b) Thick wire of few turns
(c) Thick wire of more turns
(d) Thin wire of more turns

RRB Bhubaneswar JE-II, 29.11.2018

Ans : (b) Series magnet or current coil is of thick wire of few turns where as shunt magnet or voltage coil is of thin wire of more turns.

33. To get quick and reliable readings of indicating instrument those are to be

(a) Under damped
(b) Over damped
(c) Critically damped
(d) Slightly less than critical damped

RRB Kolkata SSE-09.09.2012

Ans. (d) : Damping torque is provided in indicating type instruments such that pointer gets damped out as quick as possible. If we provide critically damped response, instrument may get damaged due to very fast response and for over damped response, it may become a sluggish response. Thus system should be work in under damped response such that speed of operation should be quite high. Hence instruments response should be slightly less than critically damped.

34. The internal resistance of the milliammeter must be very low for

(a) high accuracy
(b) high sensitivity
(c) minimum effect on the current in the circuit
(d) maximum voltage drop across the meter

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (c) Internal resistance of an milliammeter is very low because low resistance causes low effect on the circuit current. Internal resistance affect the meter current so low resistance will increase the accuracy of ammeter.

35. A moving iron instrument can be used for

(a) DC only (b) AC only
(c) Resistance only (d) Both AC and DC

RRB JE 19.09.2019 Shift-II
LMRC JE 2016
DMRC JE 2015
RRB SSE (Shift-III), 01.09.2015
RRB Jammu JE-25.10.2009

Ans. (d) A moving iron instrument can be used for both AC and DC.

- A moving iron instrument measures r.m.s. value and uses air friction damping.
- Moving iron instrument used as ammeter and voltmeter.
- Moving iron instruments are two type -
  (i) Repulsion type
  (ii) Attraction type

36. The breaking torque of induction type single-phase energy meter is:-

(a) Directly proportional to the square of the flux
(b) Directly proportional to the flux
(c) Inversely proportional to the flux
(d) Inversely proportional to the square of the flux

RRB Allahabad JE-09.09.2012

Ans. (a) : The braking torque–

$$T_b \alpha \frac{\phi_b^2 N}{R}$$

ϕ_b = The flux of braking magnet,
N= The speed of the rotating disc
R= The resistance of The eddy current path.

37. A meter has full scale deflection of 90° at a current of 1A. The response of the meter is square law. Assuming spring control, the current for a deflection of 45° will be/

(a) 0.50 A (b) 0.707 A
(c) 0.25 A (d) 0.67 A

RRB JE- 01.09.2019

Ans. (b) : Given,

$$\theta_1 = 90^o, \ \theta_2 = 45^o, \ I_1 = 1A.$$

$$\theta \propto I^2$$

$$\frac{\theta_1}{\theta_2} = \left(\frac{I_1}{I_2}\right)^2$$

$$\frac{90^o}{45^o} = \left(\frac{1}{I_2}\right)^2$$

$$I_2^2 = \frac{1}{2}$$

I_2 = 0.707 Ampere

38. Which of the following is not correct?

(a) Voltmeter should have a very high resistance
(b) An ammeter should have a very low resistance
(c) A shunt should have a very low resistance
(d) An electronic voltmeter draws appreciable current from source

RRB JE (Shift-2), 29.8.2015

Ans : (d)

- Ideal voltmeter should have infinite resistance while practical voltmeter has very high resistance.
- Ideal ammeter will have zero internal resistance while practical ammeter has very low resistance.
- An electronic voltmeter draws negligible current from the source because it has a high input resistance, therefore option 'd' is not correct.

39. Wattmeter cannot be designed on the principle of–

(a) electrostatic instrument
(b) thermocouple instrument
(c) moving iron instrument
(d) electrodynamic instrument

RRB JE (Shift-III), 26.08.2015

Ans : (c) According to working principle, wattmeters are three types-
• Dynamometer type
• Electro-static type
• Induction type
Wattmeter can not be designed on the principle of moving iron instrument.

40. An electronic voltmeter gives more accurate readings in high-resistance circuits as compared to a non-electronic voltmeter because of its

(a) low meter resistance (b) high kΩ/V rating
(c) high V/kΩ rating (d) high resolution

RRB Chandigarh SSE-15.03.2009

Ans. (b) : An electronic voltmeter gives more accurate readings in high-resistance circuits as compared to a non-electronic voltmeter because of its high kΩ/V rating.

41. The most efficient form of damping employed in electric instruments is:

(a) Air friction damping
(b) Fluid friction damping
(c) Eddy current damping
(d) None of the above

RRB SSE (Shift-III), 01.09.2015), AAI 26.4.15
RRB Gorakhpur Electronic – 2014

Ans. (c) : Eddy current damping is a most efficient form of damping employed in electric instruments.
- Air friction damping - Moving iron, electrodynamometer type instruments.
- Fluid friction damping - Electrostatic voltmeter uses fluid friction damping.
- Eddy current damping-Used in PMMC instruments.

Controlling torque - The controlling torque is provided by spring or gravity control.
- Gravity controlling torque is used in vertically mounted instruments only.

$$T_C \propto \sin\theta$$

- Hair spring is used to provides the controlling torque in both horizontal and vertical position.

$$T_C \propto \theta$$

42. Wattmeter cannot be designed on the principle of–

(a) electrostatic instrument
(b) thermocouple instrument
(c) moving iron instrument
(d) electrodynamic instrument

(RRB JE (Shift-III), 26.08.2015)

Ans : (c) According to working principle, wattmeters are three types-
• Dynamometer type
• Electro-static type
• Induction type
Wattmeter can not be designed on the principle of moving iron instrument.

43. Which of the following is the cause of a speed error in induction type energy meter?

(a) Incorrect position of brake magnets
(b) Incorrect adjustment of the position of shading bands
(c) Slow but continuous rotation of aluminum disc
(d) Temperature variations

RRB Allahabad JE-25.10.2009

Ans. (a) : Incorrect position of brake magnets is the cause of a speed error in induction type energy meter because of speed of disc (N) is inversely proportional to position of permanent brake magnet (d).

$$N \propto \frac{1}{d}$$

44. The damping force acts on the moving system of an indicating instrument only when it is

(a) Moving
(b) Stationary
(c) Near its full deflection
(d) Just starting to move

RRB SSE Secunderabad (Shift-I), 02.09.2015

Ans : (c) The damping force acts on the moving system of an indicating instrument only when it is near to full deflection.

Essential torques in secondary instruments are-

- Deflecting torque
- Controlling torque
- Damping torque

45. Damping of deflecting type instruments is done to

(a) Reduce the oscillation of the pointer in the final deflected position
(b) Make the moving system slow
(c) Make the moving system fast
(d) Reduce the angle of deflection of the pointer on the graduated scale

RRB SSE Secunderabad (Shift-I), 02.09.2015

Ans : (a) The deflecting torque is used for deflection, the controlling torque acts opposite to the deflecting torque. Damping of deflecting type instruments is done to reduce the oscillation of pointer in the final deflected position.

The following mechanism can be used for producing damping torque -

- Air friction damping
- Fluid friction damping
- Eddy current damping

46. Which meter/instrument are used measurement only direct current.

(a) Moving iron type
(b) Permanent magnet type
(c) Electro-moving type
(d) Hot wire type

RRB Allahabad Electronic (Paper-I) – 2014

Ans : (b) Permanent magnet type meter/instrument are used for the measurement of only direct current.

Advantage of PMMC -

- It has a linear scale.
- It has high torque to weight ratio of moving parts.
- The power consumption is very low.
- Error due to stray magnetic field are less.

47. An induction meter can handle current upto :

(a) 10A (b) 30A
(c) 60A (d) 100A

RRB Mumbai 2015

Ans : (d) An induction meter can handle current up to 100A.

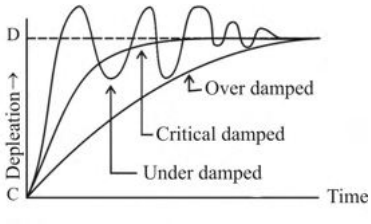
- Induction meter used only for AC.
- Scale of induction type meter is 300º.
- Induction type of energy meter is based on the electromagnetic induction principle.

48. In case of over damping the instrument will become

(a) Oscillating (b) dead
(c) fast and sensitive (d) slow and lethargic

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (d) In case of over damping the instrument will become slow and lethargic.
An over damped system would never allow the system to reach the desired end state since it is over damped and that's why they are never used.



Over damping - The value of the damping is greater than1.

49. A moving iron instrument gives correct reading when used at–

(a) low frequency
(b) high frequency
(c) only one frequency
(d) all frequencies to a certain value

RRB JE (Shift-I), 29.08.2015

Ans : (c) A moving iron instrument gives correct reading when used at only one frequency.

- Moving iron instrument measure both ac and dc.
- It has non-uniform scale.
- Moving iron used to under severe over load conditions.

In M.I. type instrument-
For Ammeter-
to minimize error at high frequency in MI ammeter an inductive shunt resistance is connected in parallel with meter.

$$\tau_{sh} = \frac{L_{sh}}{R_{sh}} = \frac{L_m}{R_m}$$

For voltmeter: A capacitor is connected in parallel with series multiplier (R_s)

$$C = 0.41\frac{L_m}{R_s^2}$$

i.e. in case of MI type voltmeter, error due to frequency will be zero.

- In moving iron instruments controlling torque is provided by spring.

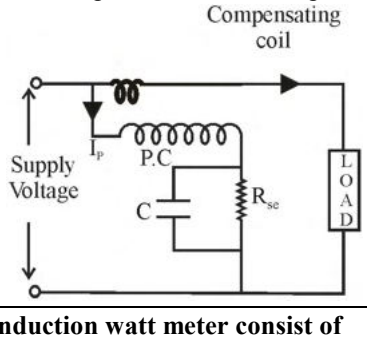
50. A compensated wattmeter has its reading corrected for error due to:

(a) Frequency
(b) Friction
(c) Power consumed in current coil
(d) Power consumed in pressure coil

RRB Gorakhpur SSE-09.09.2012
RRB Bhopal SSE-09.09.2012

Ans. (d) : In the compensated wattmeter, a compensation coil having the same number of the turn as the current coil is wound on the current coil and is connected in series with the potential coil.

- The current in the compensating coil flows in a direction opposite to that of the current in the current coil, & therefore its effect on the wattmeter field is nullified in some cases it is convenient also to have the effect of the voltmeter current nullified in the wattmeter, so that the voltmeter not be disconnected when wattmeter is read.
- A compensated wattmeter has its reading corrected for error due to power consumed in pressure coil.



51. An induction watt meter consist of

(a) series electromagnet
(b) shunt electromagnet
(c) permanent magnet
(d) series and shunt electromagnet

RRB Chandigarh SSE- 09.09.2012

Ans. (d) : An Induction wattmeter consist of series and shunt electromagnet to work as a current coil and voltage coil respectively.

52. Which of these instruments has highest power consumption?

(a) Dynamometer (b) Electrostatic
(c) Moving coil (d) Hot Wire

RRB SSE (Shift-III), 03.09.2015

Ans : (d) Hot wire instrument has highest power consumption.

- Hot wire is made up of platinum-Iridium wire.
- This meter is calibrated in terms of rms value.
- Hot wire has a non-uniform scale.
- Controlling torque provided by spring.

53. A power factor meter has

(a) one current and one pressure circuit
(b) one current circuit and two pressure circuits
(c) two current circuits and two pressure circuits
(d) two current circuits and one pressure circuit

RRB SSE (Shift-III), 03.09.2015

Ans : (b) A power factor meter has one current circuit and two pressure circuits.

- The meter has two identical pressure coils. Both the coils are pivoted on spindle.
- A power factor meter has no control springs.

54. How can be DC current measure ?

(a) Directly a DC potentiometer
(b) A DC potentiometer connected across a standard resistance
(c) A DC potentiometer connected with a volt ratio box
(d) A DC potentiometer combined with a volt ratio box and standard resistance

(RRB JE Bhopal Paper II (Shift-II), 26.08.2015)

Ans : (b) DC current measure by dc potentiometer connected across a standard resistance.

Potentiometer-

- Potentiometer is a null type instrument.
- These are used for finding the unknown voltage source.
- Once the potentiometer is standardized, working current can never change.
- Unknown voltage, $V_2 = \left(\frac{\ell_2}{\ell_1}\right).V_1$.

55. The type of wattmeter commonly used for measurement of power in AC circuits is:

(a) Moving iron type
(b) Thermocouple type
(c) Rectifier type
(d) Dynamometer type

Noida Metro Rail Corporation-05.03.2017
RRB SSE (Shift-II)- 01.09.2015
RRB Bengalore SSE-09.09.2012

Ans : (d) Electrodynamometer type wattmeter commonly used for the measurement of power in AC circuits. It's working depends on the interaction between the magnetic field of fixed and moving coils. It used for both AC and DC power measurement but generally used for AC power.

56. By which can the measurement of alternating current be done?

(a) Moving iron repulsion type voltmeter
(b) Permanent Magnet type Ammeter
(c) Electronic Voltmeter
(d) Induction Ammeter

RRB Guwahati Electronic – 2014

Ans : (d) By using induction ammeter the measurement of alternating current can be done.

Induction type instrument -

- Induction type of instruments are used to measure ac quantities only.
- These have scale range of 300º.
- It is free from stray field effect.
- Induction type instruments are used as ammeter, voltmeter, wattmeter and energy meter.

57. Deflecting torque is produced by :

(a) Gravity control (b) Spring control
(c) Air friction (d) Magnetization

RRB Bhopal Electronic–2014

Ans : (d) Deflecting torque is produced by magnetization.

Controlling torque -

- Gravity control
- Spring control

Damping torque -

- Air friction
- Eddy current
- Fluid friction

58. Which of the following types of instruments is used only in DC measurements?

(A) PMMC type
(B) Dynamometer type
(C) Shaded-pole type
(D) Electrolytic meter

(a) A and D (b) B and C
(c) A and C (d) A and B

RRB Gorakhpur JE-2014

Ans (a) :

Type of instrument	**Value under measurement**
PMMC type	DC value (Voltage and current)
Electrolytic type	DC value (Ampere-hour)
Dynamometer type	AC and DC value (Voltage, current and power)
Shaded-pole type	AC value (Voltage and current)

59. Hot wire instruments read

(a) Peak values (b) R.M.S. values
(c) Average values (d) None of the above

LMRC -2015
(RRB Ajmer 2014)

Ans. (b) : Hot wire instruments read R.M.S. value.
The deflection produce in hot wire is directly proportional to the wire extension due to the heat produced in the wire. Hot wire instruments read rms value of the current and the reading is independent of the waveform and frequency. It has non-uniform scale.

60. An electrodynamometer instrument can be used as

1. Wattmeter and VAR meter.
2. Power factor meter and Frequency meter.
3. Transfer instrument.

Which of the above statements are correct?

(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

RRB Allahabad JE-19.12.2010

Ans. (d) : Uses of electrodynamometer instruments–

- Frequency meter
- Power factor meter
- Wattmeter and VAR meter
- Transfer instruments

Electrodynamo meter is a type of transfer instrument because this may calibrated with dc and then without modification this can be used for measure ac.

61. Rectifier type instrument can be use in-

(a) a.c. (b) d.c.
(c) Both (a) and (b) (d) Pulsating

RRB Allahabad 19.12.2010

Ans : (a) Rectifier type instruments are used for measurement of a.c. voltages and currents by employing a rectifier element, which converts a.c. to dc and then using a meter responsive to d.c. to indicate the value of rectified a.c.

62. Dynamometer type of instrument can use in-

(a) a.c. (b) d.c.
(c) Both (a) and (b) (d) Pulsating

RRB Allahabad SSE-19.12.2010

Ans : (c) Dynamometer type of instrument can be use in both AC and DC. Dynamometer type instrument used as ammeter, voltmeter and wattmeter.

63. Which of the following instruments is equally accurate on ac as well as dc circuits?

(a) PMMC voltmeter
(b) Dynamometer
(c) Moving iron ammeter
(d) Induction wattmeter

DMRC JE Electrical 2017
RRB Mumbai JE-05.10.2008

Ans. (b) : • Electro dynamometer type wattmeter used for the measurement of AC as well as DC power, it is equally accurate on AC & DC circuit.
• PMMC voltmeter is used for only DC circuit whereas induction type wattmeter is used for only AC circuit.
• Dynamometer type wattmeter has uniform scale.
• In Dynamometer type wattmeter we can obtained high degree of accuracy through careful design.

64. Swamping resistance is used to compensate error due to–

(a) Stray magnetic field
(b) Large supply voltage
(c) Large supply frequency
(d) Temperature variations

RRB Chandigarh SSE-25.10.2009

Ans. : (d) Swamping resistance is connected in series with the meter and that resistance has a negligible resistance temperature coefficient in order to reduce temperature errors in shunted ammeters. It is generally made of maganin.
Swamping resistance is used to compensate error due to temperature variations.

65. Which type instruments have hysteresis loss zero-

(a) MC (b) MI
(c) Both (d) None of the above

RRB Gorakhpur SSE-25.10.2009

Ans : (a) MC (moving coil) type instruments have hysteresis loss zero because it work on dc. In dc hysteresis loss is zero.

66. Permanent-magnet moving-coil ammeter have uniform scales. Which one of the following is the reason?

(a) due to both spring actuated damping and deflecting torque is directly proportional to current

(b) spring actuated damping
(c) deflecting torque is directly proportional to current
(d) Damping torque & current decay both are exponential
(e) eddy current damping

RRB Jammu JE-25.10.2009

Ans. (c) : PMMC Instrument-

$$Q = \frac{K}{G} I$$

The deflection is proportional to current and the scale is therefore uniformly divided. Hence, Their scales are uniform

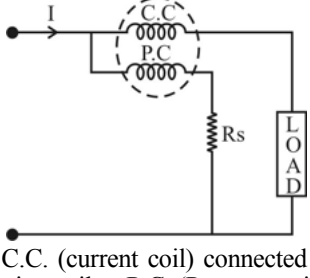
→ The permanent magnet moving coil instrument is the most accurate type for D.C. measurements.

67. Watt-meters can be grouped under_____:

(a) Moving iron instruments
(b) Moving coil instruments
(c) Electro dynamometer instruments
(d) None of these

RRB Patna JE-25.10.2009

Ans : (c) A wattmeter is used to measure the electric power in any given circuit. Analog wattmeter is an electro dynamo meter instrument. It consist of one fixed coil (current coil) and two moving coil (voltage coil).



Fixed coil or C.C. (current coil) connected in series with load while moving coil or P.C. (Pressure coil) is connected across the load carries current proportional to voltage.

68. If a wattmeter is used in a circuit it is safe voltage or current rating is exceeded, the meter will.....

(a) not be affected
(b) operated erratically
(c) immediately peg the pointer
(d) not indicate the overload

RRB Allahabad SSE-09.09.2012

Ans : (d) If a wattmeter is used in a circuit, it is safe voltage or current rating is exceeded, the meter will not indicate the overload.

$$\text{Total Power} = \sqrt{3} V_L I_L \cos\phi$$

69. In dynamometer type of wattmeter, which of the coil is spilt up into two parts?

(a) pressure coil
(b) current coil
(c) both the pressure coil and current coil
(d) None of these

RRB Allahabad SSE-09.09.2012

Ans : (b) A dynamometer type wattmeter essentially consists of two coils called fixed coil (current coil) and moving coil. The fixed coil is splitted into two equal parts which are placed parallel to each other.

70. If current through the operation coil of a moving iron instrument is doubled, the operating force becomes-

(a) One and a half times (b) 2 times
(c) 3 times (d) 4 times

RRB Malda SSE-25.10.2009

Ans. (d) : For moving iron type instrument

$$T_d = \frac{1}{2} i^2 \frac{dL}{d\theta}$$

$$T_d \propto I^2 \Rightarrow \frac{T_{d2}}{T_{d1}} = \left(\frac{I_2}{I_1}\right)^2 = \left(\frac{2I_1}{I_1}\right)^2$$

$$T_{d2} = 4T_{d1}$$

71. Dynamometer type moving coil instruments are provided with .....

(a) Eddy current damping
(b) Pneumatic damping
(c) Fluid friction damping
(d) Electrostatic damping

RRB Patna JE-25.10.2009

Ans : (b) Pneumatic dampers provide speed and motion control using gas damping in extension compression or both direction. Dynamometer type moving coil instrument are provided with pneumatic damping.

72. In an electrical measuring instrument, the controlling torque also known as :

(a) Damping torque (b) Restoring torque
(c) Operating torque (d) Deflecting torque

RRB Mumbai C& G SSE-25.10.2009

Ans : (b) In a measuring instruments, controlling torque always opposes the deflecting torque. So it can be also defined as restraining torque or restoring torque.

73. Scale of moving iron instruments is :

(a) Linear (b) Non uniform
(c) Exponential (d) Logarithmic

RRB Mumbai C & G SSE-25.10.2009

Ans : (b) As the angular deflection of moving-iron instrument is proportional to square of operating current $T_d \propto I^2$

Therefore, the instrument has basically square law response. Due to this square law response, the moving iron instrument scale is non-uniform.

74. If an induction type energy meter runs fast, it can be slowed down by:

(a) Lag adjustment
(b) Light Load adjustment
(c) Adjusting the position of braking magnet and making it come closer to the centre of the disc
(d) Adjusting the position of braking magnet and making it move away from the centre of the disc

DMRC JE 2015
RRB Chandigarh SSE-25.10.2009

Ans. (d) : The braking torque is provided by using permanent magnet

$$T_B = \frac{k\phi_{Bm}^2 NR}{R_e}$$

Where, R = radius of the disc

R_e = resistance in the path of current.
i.e. resistance of the disc
N = Speed of the disc.

Breaking torque (breaking constant K_B) can be change by changing the flux ϕ_{Pm}. and $k_B\downarrow$ as $\phi_m\downarrow$ meter can be down by adjusting the position of breaking magnet and making it move away from the centre of the disc.

75. Which of the following instruments can have a full-scale deflection of 300º?

(a) Moving coil (b) Moving Iron
(c) Induction (d) Hot wire

RRB Patna JE-25.10.2009

Ans. (c) : Induction instrument-
(1) Fairly long scale (extending over 300º)
(2) Free from the effects of stray field
(3) Good damping
(4) Practically free from frequency errors.

76. A pointer of an instrument once deflected returns to zero position, when the current is removed due to -

(a) Damping torque (b) Action of gravity
(c) Mass of the pointer (d) Controlling torque

RRB Bhopal TM SSE-25.10.2009

Ans. (d) : A pointer of an instrument once deflected returns to zero position, when the current is removed due to controlling torque. Without controlling system, the pointer would swing over its maximum deflected position irrespective of size of current and moreover, once deflected it would not return to its zero position on removing the current.

77. Which of the following meters is an integrating type instrument?

(a) Ammeter (b) Voltmeter
(c) Wattmeter (d) Energy meter

RRB Allahabad JE-19.12.2010

Ans. : (d) Energy meter or watt-hour meter is an electrical integrating types of instrument that measure the amount of electrical energy used by consumer.

78. A Current transformer has phase error of +3º. The phase angle between the primary and secondary current is

(a) 3º (b) 177º
(c) 180º (d) 183º

RRB Allahabad SSE-09.09.2012

Ans. (b) : Given – Phase error = +3º
Phase angle between the primary and secondary current,
= 180º – phase error = 180º – 3º = 177º

79. In moving iron instruments, eddy current damping cannot be used as

(a) They have a strong operating magnetic field.
(b) They are not normally used in vertical position.
(c) They need a large damping force, which can only be provided by air friction.
(d) The introduction of a permanent magnet required for eddy current damping would distort the existing weak operating magnetic field.

RRB Bangalore SSE-09.09.2012

Ans. (d) : Electromagnets are used in MI instrument operating magnetic field is very weak as compared to PMMC. If additional permanent magnets are employ for eddy current damping, it will distort the existing weak operating magnetic field which available due to electromagnet.

80. A linear scale used in ———

(a) Thermocouple meters
(b) Moving iron meters
(c) Hotwire meters
(d) None of these

RRB Kolkata SSE-09.09.2012

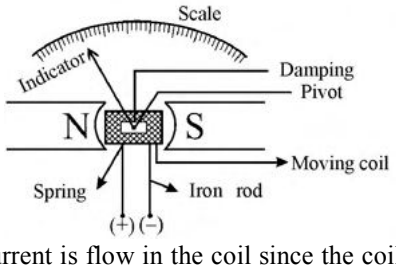
Ans. (d) : The thermocouple meter, moving iron meter, and hot wire meter are all non-uniform, i.e. the scale of these meter is non-linear. The scale of PMMC meter is linear.

81. PMMC (D'Arsonval) is used for-

(a) AC current (b) DC voltage
(c) AC voltage (d) All of the above

RRB Kolkata SSE-09.09.2012

Ans : (b) PMMC (D' Arsonval) is used for DC voltage.



When current is flow in the coil since the coil is placed in the magnetic field of a permanent magnet. Therefore due to work of mechanical force on both side of its coil then the moving coil is deflects on its pointer. Its cost is more. They can be used only in DC voltage not in AC.

82. The deflecting torque of a moving iron type ammeter is directly proportional to :

(a) Square root of current
(b) Cube of the current
(c) Current
(d) Square of the current

RRB Bhopal SSE 09.09.2012

Ans. (d) : The deflecting torque of moving Iron type Ammeter is given by -

$$T_d = I_{rms}^2 \left(\frac{dM}{d\theta}\right)$$

Hence $T_d \propto I_{rms}^2$

83. In indicating instruments the springs are mainly used to

(a) conduct the current to the coils
(b) hold the pivot in position
(c) control the pointer movement
(d) reduce the vibration of the pointer

RRB Bhopal SSE-09.09.2012

Ans: (c) Spring provides the controlling force in the measuring instrument if the controlling force is absent the pointer will not come back to the starting position i.e. zero.

84. Which torque is essential for indicating instruments-

(a) Deflecting (b) Controlling
(c) Damping (d) All of the above

RRB SSE (Shift-III) 02.09.2015

Ans : (d) For indicating instruments deflecting, controlling and damping torque is essential. Ammeter, voltmeter, wattmeter, ohmmeter and power factor meter are the category of indicating instruments.

85. An induction wattmeter can be used for:

(a) both D.C. and A.C (b) D.C. only
(c) A.C. only (d) any of the these

RRB JE (Shift-I), 29.08.2015

Ans. (c) : An induction wattmeter can be used only for AC,

⇒ The induction wattmeter works on the principle of electromagnetic induction.

⇒ The scale is uniform and extends up to 300º range of scale.

⇒ In induction type wattmeter eddy current damping is used.

86. For the measurement of electrical energy, we may use a :

(a) Wattmeter
(b) kWh meter
(c) Multimeter
(d) Voltmeter, ammeter and PF meter

RRB SSE (Shift-III), 01.09.2015

Ans.(b): For the measurement of electrical energy, we may use a kWh meter.

⇒ Electrical energy is the product of electrical power and time and it is measured in joules. It is defined as "1 Joule of energy is equal to 1 watt of power is consumed for 1 second."

Energy = Power × Time

1 Joule = 1 watt × 1 second

87. Wattmeter is of :

(a) PMMC type
(b) Dynamometer type
(c) Moving iron type
(d) Hot wire type

RRB SSE (Shift-II), 01.09.2015

Ans. (b) : Wattmeter is generally of dynamometer type.

- The fixed coils or current coil are connected in series with the load and carry the load currents.
- The moving coil is connected across the load and carries current proportional to voltage. It is also called potential coil or pressure coil.
- Air friction damping is used in dynamometer type wattmeter.
- Spring is used which provides the controlling torque.
- Dynamometer type wattmeter scale is linear.

88. The damping force acts on the moving system of an indicating instrument only when it is

(a) Moving
(b) Stationary
(c) Near its full deflection
(d) Just starting to move

(RRB SSE Secunderabad (Shift-I), 02.09.2015)

Ans : (a) Damping force is necessary to bring the moving system to rest and indicate final (steady) position in short time. Damping force acts. in an indicating instrument when system (pointer) is in motion.

89. In a portable instrument, the controlling torque is provided by :

(a) Spring (b) Gravity
(c) eddy currents (d) damping friction

(RRB SSE (Shift-I), 03.09.2015)

Ans : (a) In portable instrument, the controlling torque is provided by spring control. The spring is made of non-magnetic material such as phosphor bronze. When pointer deflects the spring twists in the opposite direction and produce a restoring torque.

90. Which of the following instruments has uniform scale?

(a) Electrodynamic type (b) PMMC type
(c) Moving iron type (d) Dynamometer type

RRB SSE (Shift-III) 01.09.2015

Ans. (b) : PMMC type- PMMC type instrument has a uniform scale and can cover an arc of 270 degree.
for constant condition = $T_d = T_c$

$$\boxed{\theta \propto I}$$

PMMC type instrument work only D.C. supply.

91. In an energy meter, braking torque is produced to–

(a) safe guard it against creep
(b) brake the instrument
(c) bring energy meter to stand still
(d) maintain steady speed and equal to driving torque

RRB JE (Shift-III), 26.08.2015

Ans. (d) : In an energy meter a braking torque is produced to maintain a steady speed and equal to driving torque.

$\Rightarrow$ Because of breaking torque, it runs at steady state.

$$T_B \propto N\phi_m^2 .d$$

$$N \propto \frac{T_B}{d\phi_m^2} \Rightarrow N \propto \frac{1}{d}$$

d = distance between spindle and permanent magnet

92. Which one of the following is the main cause of magnetic decay in PMMC type instrument?

(a) Variation in the resistance of the moving coil
(b) Quality of spring
(c) Aging of the spring
(d) Aging of the magnets

RRB Mumbai JE-05.10.2008

Ans. (d) : Aging of the magnets is the main cause of magnetic decay in permanent magnet moving coil instrument. Because Magnetism of permanent magnet decreases with respect to time and temperature pressure also heavily effects permanent magnet. The instrument cost is high and variation is found in magnet strength

93. Two wattmeters are used to measure the power in a three-phase balanced load. The wattmeter readings are 8.2 kW and 7.5 kW. The active power will be:

(a) 61.5 W (b) 0.997 W
(c) 0.7 W (d) 15.7 W

RRB Mumbai JE-05.10.2008

Ans. (d) :

$$\boxed{\text{Active power} = W_1 + W_2}$$

Active power = 8.2 +7.5 = 15.7 kW

$$\boxed{\text{Reactive power} = \sqrt{3}\left(W_1 - W_2\right)}$$

94. Sensitivity of voltmeters is expressed in:

(a) Ω/A (b) kΩ
(c) kΩ/V (d) kΩ/A

RRB Gorakhpur SSE-25.10.2009

Ans. (c) : Sensitivity of any voltmeter is defined as the reciprocal of current.

$$S = \frac{1}{I_{f(FSD)}}$$

$$\boxed{\text{Unit} = k\Omega/\text{volt}}$$

95. The range of a permanent magnet moving coil instrument used as an ammeter can be increased by :

(a) connecting a high resistance in series with the instrument
(b) connecting a low resistance in series with the instrument
(c) connecting a low resistance in parallel with the instrument
(d) connecting a high resistance in parallel with the instrument

RRB JE 30.08.2019, Shift-II
LMRC JE 2016, ESE 2016
DMRC JE 2015

Ans : (c) The range of a permanent magnet moving coil instrument used as an ammeter can be increased by connecting a low resistance in parallel with the instrument. If the ammeter is placed across the supply so the coil of ammeter will get full voltage and the resistance of the ammeter coil is low then more current will flow through it, which will burn the ammeter.

96. Wattmeter cannot be designed on the principle of–

(a) electrostatic instrument
(b) thermocouple instrument
(c) moving iron instrument
(d) electrodynamic instrument

RRB JE (Shift-III), 26.08.2015

Ans. (c) : Wattmeter cannot be designed on the principle of moving iron device.
According to the working principle, there are three types of wattmeters–
(i) Electrodynamometer type wattmeter
(ii) Electrostatic type wattmeter
(iii) Induction type wattmeter
⇒ Moving iron instrument is used to measure current and voltage.

97. For increasing the range of voltmeter, one should connect a

(a) High value resistance in series with voltmeter
(b) Low value resistance in series with voltmeter
(c) High value resistance in parallel with voltmeter
(d) Low value resistance in parallel with voltmeter

RRB-Jharkhand-2014
RRB SSE Bilaspur Yellow paper, 21.12.2014
DMRC JE 03.08.2014
RRB Mumbai SSE-19.12.2010

Ans. (a) : For increasing the range of voltmeter, high value resistance is connected in series with voltmeter.

$R_{se} = R_m(m-1)$

R_{se}- External high value resistance (multiplier)

R_m - Voltmeter resistance

$$m = \frac{\text{Total voltage to be measure}}{\text{Voltage across voltmeter}} = \frac{V}{V_m}$$

m- Multiplying factor.

98. The household energy meter is :

(a) an indicating instrument
(b) a recording instrument
(c) an integrating instrument
(d) both integrating and indicating instrument

RRB JE Bhopal Paper-I (Shift-II), 28.08.2015
RRB Mumbai 2015

Ans. (c) : The household energy meter is an integrating type instrument.

Integrating type instruments –

These instruments give the integration of the inputs applied over a particular period of time.

Example – Watthour meter, Ampere-hour meter etc.

99. A voltmeter must have a very high internal resistance so that the:

(a) accuracy is high
(b) resolution is high
(c) meter draws minimum current
(d) loading is maximum

RRB SSE Secunderabad (Shift-I), 02.09.2015
RRB Mumbai C& G JE-25.10.2009

Ans. (c) A voltmeter is always connected in parallel across the device to measure the voltage across it. Now if the voltmeter has low internal resistance, then the high current will flow through the voltmeter and the meter would damage. So that voltmeter has high internal resistance so that meter draws minimum current.

100. Induction type single phase energy meters measure electric energy in :

(a) kW (b) Wh
(c) kWh (d) VAR

RRB Mumbai 2015,
RRB SSE (shift-III), 02.09.2015

Ans. (c) : Induction type 1–ϕ energy meter :

$$\boxed{E = \int_0^t P.dt} \text{ or energy} = \int VI\cos\phi dt$$

⇒ Energy is measured in kWh.

1 unit = 1 kWh

1 unit = 1000 W × 60 × 60 sec

$$= 1000\frac{\text{Joule}}{\text{Sec}} \times 3600 \text{ sec}$$

$\boxed{1 \text{ unit} = 3.6 \times 10^6 \text{ Joule}}$

101. In order to increase the range of measuring voltage, ... is connected in ..... with voltmeter.

(a) high resistance, series
(b) low resistance, series
(c) high resistance, parallel
(d) low resistance parallel

DMRC JE- 20.04.2018

Ans : (a) A voltmeter is used to measure the potential difference between two points of a circuit. In order to increase the range of measuring voltage high resistance is connected in series with voltmeter.

102. Determine the value of current (in mA) for the full–scale deflection of a voltmeter, when the sensitivity of the voltmeter is 50 ohm/Volt.

(a) 1 (b) 2
(c) 10 (d) 20

RRB Mumbai SSE-05.10.2008

Ans : (d)

$$\text{sensitivity} = \frac{1}{I_{fsd}} = \frac{R}{V_m} = \frac{\Omega}{V}$$

$$I_{fsd} = \frac{1}{\text{sensitivity}} = \frac{1}{50} = 0.02$$

$$\boxed{I_{fsd} = 20\ \text{mA}}$$

103. A voltmeter has _____ resistance.

(a) 100 ohms (b) very low
(c) very high (d) zero

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (c) : A voltmeter has very high resistance.

Voltmeter -

- Voltmeter are connected across circuit.
- Ideal voltmeter has infinite internal resistance.
- Minimum current flows through the voltmeter due to very high internal resistance.

104. The purpose of a shunt in an ammeter is to-

(a) Increase the sensitivity of the ammeter
(b) Bypass the current
(c) Increase the sensitivity of the ammeter or by pass the current
(d) Increase the resistance of the ammeter

RRB JE Chennai -2014

Ans : (b) The purpose of a shunt in an ammeter is to bypass the current.

- When high current is to be measured most of the current is bypassed through a low resistance called a shunt.

$$\boxed{R_{sh} = \frac{R_m}{M-1}}$$

- Shunt resistance after addition of swamp resistance.

$$\boxed{R_{sh} = \frac{R_m + R_{swamp}}{M-1}}$$

- Shunt should have small and constant temperature coefficient.
- The material used for shunt in PMMC is manganin.

105. The basic meter movement can be converted into an ohmmeter by connecting a _____ with it.

(a) High resistance in series
(b) Low resistence in parallel
(c) Battery and a variable resistance in series
(d) Battery in series

NMRC Electronics 14.09.2019, 12:00 – 2:15 PM

Ans. (c) : The basic meter movement can be converted into an ohmmeter by connecting a battery and a variable resistance in series with it.
The ohmmeter is an instrument used to measure electric resistance.
Types of ohmmeter -
(1) Series type ohmmeter → Scale range, ∞ to 0
(2) Shunt type ohmmeter → Scale range, 0 to ∞
The ohm-meter reading of a short circuited capacitor is zero.

106. A voltmeter must have a very high internal resistance so that the:
(a) accuracy is high
(b) resolution is high
(c) meter draws minimum current
(d) loading is maximum

RRB SSE Secunderabad (Shift-I), 02.09.2015

Ans : (c) A voltmeter must have a very high internal resistance so that the current flowing through voltmeter is almost negligible.
- If voltmeter's internal resistance is low then more current will divide through voltmeter hence more voltage drop occurs across the voltmeter.
- Voltmeter's range can be extended by using series multipliers.
- Ammeter's range can be extended by using shunt across the meter.

107. The multiplier and the meter coil in a voltmeter are connected in:
(a) Series (b) Parallel
(c) Series-parallel (d) No connection

LMRC JE Electronics 2016
RRB SSE (Shift-I), 03.09.2015

Ans : (a) The multiplier and the meter coil in a voltmeter are connected in series. The basic meter converted into a voltmeter by connecting a series resistance.
- The multiplier resistance (R_s) should be greater than the meter resistance (R_m). Multiplier resistance is made up of manganin and constantan.
- To reduce the loading effect, high sensitivity voltmeter is used.

108. An instrument transformer is used to extend the range of–
(a) induction instrument
(b) electrostatic instrument
(c) moving coil instrument
(d) PMMC instrument

RRB JE (Shift-III), 26.08.2015

Ans : (a) An instrument transformer is used to extend the range of induction instruments like ammeter and voltmeter.
Instruments transformer are used to measure high voltage and high current.
There are two types of instruments transformer–
1. C.T. → It is a step up transformer.
2. P.T. → It is a step down transformer.

109. Creeping in energy meter can be avoided by:

(a) Using shading bands around the central limb of shunt magnet
(b) Using adjustable resistance
(c) Providing a small shading loop between the central pole of shunt magnet and the disc
(d) Drilling two diametrically opposite holes in the disc

RRB Malda SSE-25.10.2009
DFCCIL JE 17.04.2016

Ans. (d) : Creeping in energy meter can be avoided by drilling two diametrically opposite holes in the disc.

Creeping error- Sometimes even when there is no charge on the energy meter, only the potential coil keeps moving very slowly, only when the potential coil is excited, this type of error in the meter is called creeping error. To remove this error two holes are made on the disk on either side of the axis in such a way that the braking magnets pass thorough the magnetic field. At zero load state when any of the holes come under the resistor coupler in this case the disc stops.

110. Electrolytic type of energy meter can work in which of the following circuits?

(a) Magnetic circuit (b) AC only
(c) DC only (d) DC and AC both

DFCCIL Executive (EE) -30.09.2021

Ans. (c) : Electrolytic type of energy meter can work in DC circuit only.

(Instruments)	Types of supply
PMMC Type	Only D.C.
Moving iron type	A.C. and D.C.
Electrodynamometer type	A.C. and D.C.
Hot wire type	A.C. and D.C.
Electrolytic type	Only D.C.
Induction type	Only A.C.
Electrostatic type	A.C. and D.C. (Voltage only)

111. Extension of moving iron ammeter range can be done by using

(a) Multiplier (b) Capacitor
(c) Shunt (d) Inductor

RRB Allahabad JE-25.10.2009

Ans. (c) : A shunt resistance can be used to extend the range of a moving iron type of ammeter because it will reduce the voltage drop that occurs due to instruments internal resistance.

112. Which instrument has the multiple shunt or series resistances inside the meter?

(a) Moving coil galvanometer
(b) Multimeter
(c) Multirange meter
(d) Wattmeter

RRB Allahabad JE-25.10.2009

Ans. (c) : In multi range meter there are multiple shunts and series coils connected inside the meter to increase the range of instrument.

113. In a CRO which of the following is not a part of electron gun.

(a) Cathode (b) Grid
(c) Accelerating anode (d) X-Y plates

RRB JE- 01.09.2019
DMRC Electronic, 2016
RRB JE (Shift-III) 28.08.2015

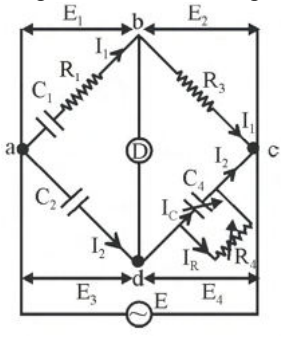
Ans . (d): In a CRO part of electron gun are cathode, grid and accelerating anode while x-y plates is not a part of electron gun.
The main part of a CRO is CRT. A CRT is stands for cathode ray tube.
CRO- A cathode ray oscilloscope is a kind of laboratory instrument, used to display the analysis and measurement of waveforms.
CRO is an extremely quick X-Y plotter that shows the input signal with respect to time.

114. Which one of the following bridges is used for measurement of dielectric loss and power factor of a capacitor?

(a) Maxwell's bridge (b) Anderson bridge
(c) De Sauty's bridge (d) Schering bridge

RRB Allahabad JE-25.10.2009

Ans. (d) : Schering bridge is used for measurement of dielectric loss and power factor of a capacitor.



Capacitance $C_1 = C_2 \frac{R_4}{R_3}$

Dissipation factor $D = \tan\delta = \omega R_4 C_4$

115. Three wattmeter method of power measurement can be used to measure power in:

(a) Both balanced and unbalanced Circuits
(b) Balanced Circuits
(c) None of the options
(d) Unbalanced Circuits

RRB JE 19.09.2019 Shift-II
RRB Allahabad JE-09.09.2012

Ans. : (a) Three wattmeter method of power measurement can be used to measure power in both balanced and unbalanced circuit.

116. The current coil of a single-phase energy meter is wound on

(a) One limb of the laminated core
(b) Both the limbs of the laminated core with same number of turns
(c) Both the limbs of the laminated core with different number of turns
(d) The center of the limb on the laminated core

RRB Bhubaneswar JE 29.11.2018

Ans. (b) : Series magnet having two limbs, hence current coil is connected in two limbs with equal number of turns. Therefore option (b) is most suitable and correct option.

117. CRO can display

(a) DC signal only
(b) AC signal only
(c) Both D.C. and A.C. signal
(d) Time invariant signal

RRB Ajmer Electronic – 2014

Ans . (c): CRO can display, both DC and AC signal
CRO- A cathode ray oscilloscope is a kind of laboratory instrument, used to display the analysis and measurement of waveforms.
CRO is an extremely quick X-Y plotter that shows the input signal with respect to time.

118. Bridge suited for measurement of low Q-factor inductance is:

(a) Hay's bridge (b) Maxwell's bridge
(c) Schering bridge (d) Anderson's bridge

NMRC JE 2017
RRB Bhubaneswar JE-II, 19.12.2010

Ans : (d) Bridge suited for measurement of low Q-factor inductance is Anderson's bridge.

- Bridge suited for measurement of medium Q-factor inductance is Maxwell's bridge.
- Bridge suited for measurement of high Q-factor inductance is Hay's bridge.
- Schering bridge is used to measure capacitance and dielectric loss.

119. A double beam oscilloscope has-

(a) Two screens
(b) Two electron guns
(c) One vertical amplifier
(d) Two different phosphor coatings

RRB JE 31.08.2019

Ans. (b) : A double beam oscilloscope has two electron guns.
Double beam oscilloscope has two different electron guns which passes through two completely separate vertical channels.
A dual-trace oscilloscope has single electron beam which get split into two passes through two separate channels.

120. Which of the following is NOT the correct representation of the balanced condition of AC bridges?

(a) $I_1 = I_3, I_2 = I_4$
(b) $|Z_1| + |Z_4| = |Z_2| + |Z_3|$
(c) $\theta_1 + \theta_4 = \theta_2 + \theta_3$
(d) $|Z_1|\,|Z_4| = |Z_2|\,|Z_3|$

RRB Chennai Technical Engg.15.04.2007

Ans. (b) : The expression given below does not represent balance condition of alternating current bridge:- $\{|Z_1| + |Z_4| = |Z_2| + |Z_3|\}$

121. Determine the deflection sensitivity (in m/V) of a CRO, when the value of the deflection factor is 0.5 V/m.

(a) 1 (b) 2
(c) 3 (d) 4

RRB Patna Technical Engg.27.07.2008

Ans : (b) It is given,

Deflection factor = 0.5 Volt/m

$$\left[\text{Deflection Sensitivity} = \frac{1}{\text{Deflection factor}}\right]$$

$$= \frac{1}{0.5} = 2$$

$$[\therefore \text{Deflection sensitivity} = 2\text{m/v}]$$

122. Determine the bandwidth (in Hz) of a sine wave that is reproduced by a CRO having a rise time of 70 ms.

(a) 5 (b) 10
(c) 15 (d) 20

RRB Chennai Technical Engg.15.04.2007

Ans : (a)

$$\left[\text{Bandwidth} = \frac{0.35}{\text{Rise time}}\right]$$

Rise time = 70 m-sec = 70×10^{-3}sec

$$\text{Bandwidth} = \frac{0.35}{70\times10^{-3}} = \frac{350}{70}$$

$$\boxed{\text{Bandwidth} = 5}$$

123. The deflection sensitivity of the CRO is 10 m/V. What is the value of deflection factor (in V/m)?

(a) 10 (b) 0.1
(c) 1 (d) 0.01

RRB Chennai Technical Engg.15.04.2007

Ans. (b) : Deflection sensitivity = 10m/V

Deflection factor = ?

$$\left[\text{Deflection factor} = \frac{1}{\text{Deflection Sensitivity}}\right]$$

$$\text{Deflection factor} = \frac{1}{10} = 0.1$$

124. Which element in CRO is used to collect secondary emission electrons?

(a) Deflection plates (b) Aquadag
(c) Graticules (d) Phosphor screen

DMRC JE 20.02.2020
RRB Allahabad JE-25.10.2009

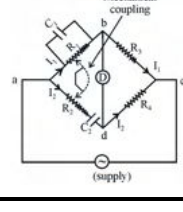
Ans. (b) : Aquadag is used in CRO to collect secondary emission Electrons. Aquadag is a trade name for a water based colloidal graphite coating commonly used in cathode ray tubes. It is used as an electrically conductive coating on insulating surfaces, and as a lubricant. The name is shortened form of "Aqueous Deflocculated Acheson Graphite."

125. Frequency can be measured by using

(a) Maxwell's bridge
(b) Schering bridge
(c) Heaviside Campbell bridge
(d) Wien's bridge

RRB Chennai Technical Engg.15.04.2007

Ans.(d): Wien's bridge is used for frequency measurement



frequency (f) = $\frac{1}{2\pi\sqrt{R_1R_2C_1C_2}}$ Hz

For $R_1 = R_2 = R$ and $C_1 = C_2 = C$

$$f = \frac{1}{2\pi RC}$$

126. A vertical amplifier for a CRO can be designed for–

(a) A low gain (b) A high gain
(c) A varying gain (d) A constant gain

RRB Patna/Allahabad ESM-III, 30.01.2011

Ans. (d) : A vertical amplifier for a CRO can be designed for a constant gain. We feed the signal to be analyzed in the vertical amplifier. This is to amplify the signal before feeding it to the horizontally placed Y-deflecting plates. Hence, the vertical amplifier only amplifier the input signal of the CRO.

• It must be designed to have sufficient gain to drive the deflecting plates.

127. The delay line in CRO is placed after-

(a) Horizontal amplifier (b) Vertical amplifier
(c) Trigger circuit (d) Power supply

RRB Chandigarh SSE-15.03.2009

Ans : (b) The delay line in CRO is placed after vertical amplifier. It allows few nanoseconds of time delay in the signal, so that user is able to visualize the leading edge of the wave.

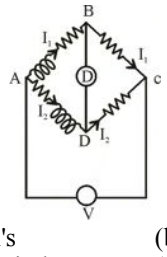
128. The connecting probe in CRO causes

(a) loading
(b) distortion in the wave
(c) loading and distortion in the wave both
(d) None of these

RRB Patna/Allahabad ESM-III, 30.01.2011

Ans. (c) : The probe performs the very important function of connecting the test circuit to the oscilloscope without altering, loading, or otherwise disturbing the test circuit. Probes cause loading and distortion in the wave.

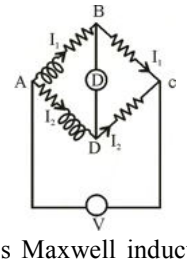
129. The circuit given below is a circuit of ……bridge :



(a) Anderson's (b) Kelvin's Double
(c) Maxwell's inductance (d) Wheatstone

RRB Chennai Technical Engg.15.04.2007

Ans : (c)



The given circuit is Maxwell inductance bridge which measures on inductance by comparison with a variable standard self inductance.

130. Cathode of CRO is coated with-

(a) Alkali material (b) Thorium oxide
(c) Copper oxide (d) Barium oxide

RRB Patna/Allahabad ESM-III, 30.01.2011

Ans : (d) Cathode of CRO is coated with Barium oxide. It emits electron beam when heated. It is heated indirectly and oxide coated.

131. Oscilloscope is basically a/an

(a) Ammeter (b) Voltmeter
(c) Wattmeter (d) Energy meter

RRB Chandigarh SSE-26.02.2012

Ans. (b) : Oscilloscope is basically a voltmeter.
An oscilloscope is a piece of equipment used to measure electronic signal. It is used to observe varying signal voltage on two dimensional of grid represents time.

132. Digital voltmeter converts _____.

(a) Resistance to voltage
(b) Analog to digital signal
(c) Current to voltage
(d) Digital to analog signal

RRB JE 31.08.2019

Ans. (b) : Digital voltmeter converts analog to digital signal.

- Digital voltmeter is a versatile and accurate voltmeter.
- Output of digital voltmeter can be fed to memory devices for storage purpose and future communications.
- A digital voltmeter displays the value of ac or dc voltage being measured directly as discrete numerical in the decimal number system.

133. Power consumption in LCD as compared to LED.

(a) Same (b) More
(c) Less (d) Difficult to define

RRB Chandigarh Electronic – 2014

Ans : (c) Power consumption in LCD as compared to LED is less.

- LCD power consumption is in μW while LED power consumption is in mW.
- The response time of LCD is in msec while LED is in μ sec.

134. Which of the following bridge is most suitable for the measurement of an unknown resistance?

(a) Hay's Bridge (b) Anderson Bridge
(c) Wien's Bridge (d) Wheatstone Bridge

RRB Chennai Technical Engg.15.04.2007

Ans : (d) Wheatstone bridge is the most suitable bridge for measuring unknown resistance. We can measure medium resistance (order of 0.1 MΩ) with the help of this bridge.

In Balance condition $\boxed{\frac{P}{R} = \frac{S}{Q}}$

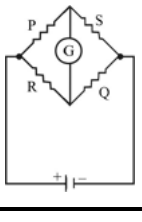
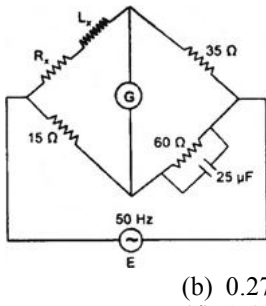


figure Wheatstone Bridge
P, Q, R and S are resistive arms of the wheatstone bridge respectively.

135. Determine the quality factor for Maxwell's inductance capacitance bridge given below, when the bridge is supplied by a frequency of 50 Hz.



(a) 0.16 (b) 0.27
(c) 0.36 (d) 0.47

RRB Chennai Technical Engg.15.04.2007

Ans : (d) In the above circuit Diagram,

$C_4 = 25\mu f = 25 \times 10^{-6}$ F

$R_4 = 60\ \Omega$

Quality factor (Q) for inductance capacitance bridge :–

$$\boxed{Q = 2\pi f C_4 R_4}$$

$\therefore\ \omega = 2 \times 3.14 \times 50 = 314$

$Q = 314 \times 60 \times 25 \times 10^{-6} = 0.47$

$$\boxed{Q = 0.47}$$

136. Clamp on ammeter is used for measurement of --------

(a) Large alternating currents
(b) Small direct currents
(c) Small alternating currents
(d) Large direct currents

DMRC-2016

Ans. (a) : • Clamp on ammeter or simply 'Clamp meter' is an instrument that is used to measure the current flowing through a conductor.

• An AC clamp meter basically consists of a current transformer in its jaw, bar CT usually. Utilizing the principal of current transformer the reading will be displayed.

• Clamp on ammeter is used for measurement of large alternating current.

137. Voltmeter calibration can be done with:

(a) a potentiometer (b) a frequency meter
(c) an ammeter (d) a CRO

RRB Jammu SSE-2013

Ans. (a) : Calibration of voltmeter using potentiometer so standard voltage cell with stable terminal value is taken as a source and connected in parallel with voltmeter which needs to be calibrated.

138. Megger is used for the measurement of :

(a) Low resistance
(b) Insulation resistance
(c) Stray resistance
(d) Earth resistance

DMRC JE 18.02.2017
LMRC JE 2016
RRB Allahabad JE-25.10.2009

Ans : (b) Megger is used for the measurement of insulation resistance. Its operating voltage 100-500 volt. Megger measures mega ohm resistance, megger is a moving coil type instrument.

139. Multiplication features are incorporated in an ohmmeter to enable the meter to_____:

(a) measure very high resistance values
(b) measure values with the least error
(c) be multipurpose in its application
(d) has less power consumption

RRB Bangalore SSE-09.09.2012

Ans : (b) Multiplication features are incorporated in an ohmmeter to enable the meter to measure values with the least error. An ohm meter is an instrument that measure the electrical resistance of a material. This instrument is connected with a battery, a series adjustable resistor and an instrument that give the reading.

140. De Sauty's Bridge is most suitable for the measurement of ……..

(a) resistance (b) inductance
(c) capacitance (d) frequency

RRB Chennai Technical Engg.15.04.2007

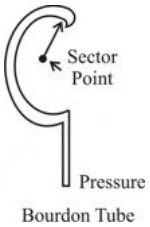
Ans : (c) De Sauty's Bridge is most suitable for the measurement of capacitance. It measures capacitance of a loss free capacitor by comparing other standard capacitor.

141. _____ is used to measure pressure directly.

(a) Rotameter (b) LVDT
(c) Strain gauge (d) Bourdon tube

RRB JE 31.08.2019
LMRC SC/TO Shift-2 JE-2016

Ans. (d) : Bourdon tube is used to measure pressure directly.



Bourdon Tube

• Bourdon tubes are made up of an elliptically flattened tube. One end of the tube is sealed or closed. The other end is open so that fluid can enter. When the fluid whose pressure is to be measured enters the tube. The tube tends to straighten out an amount of pressure applied. This causes a displacement, which is amplified further and used to move a pointer on scale.

142. _____ is used in the automatic heating appliances to control the temperature.

(a) Rectifier (b) Transformer
(c) Voltage regulator (d) Thermostat

RRB JE- 01.09.2019

Ans. (d) : Thermostat is used in the automatic heating appliance to control the temperature.

• A thermostat is device which senses the temperature of a physical system's temperature is maintained near a desired set-point.

143. The operation of a Megger is based on which of the following?

(a) Dynamometer (b) Electrostatic meter
(c) Moving coil meter (d) Moving iron meter

RRB Malda SSE-25.10.2009

Ans. (c) :
- Megger working principle is based on the working principle of moving coil instrument which states that when a current carrying conductor is for a magnetic field a mechanical force is experienced by it.
- Megger is widely used as insulator tester.

144. What are the advantages of using Electrical transducers?

(a) Small and non-portable
(b) Large and non-portable
(c) Large and portable
(d) Reduce effects of friction

RRB JE 31.08.2019

Ans. (d) : Advantage of Electrical transducer.
- Simple circuit
- Easy to operate
- Easy noise detection and removed
- Low power consumption
- It is suitable for any device or system
- It is used for process of measurement
- Low friction effect

145. Korotkoff sounds are observed during measuring the–

(a) Electrical insulation (b) Atmospheric pressure
(c) Blood pressure (d) Speed of wind flow

RRB JE- 01.09.2019

Ans. (c) : Korotkoff sounds are observed during measuring the blood pressure.

146. What does a thermocouple measure using a voltmeter-

(a) RMS Value (b) Highest value
(c) Average value (d) Peak to peak value

RRB Mumbai Electronic-2015
RRB JE Bhopal Paper-I (Shift-II), 28.08.2015

Ans. (a): A thermocouple measures RMS value by using a voltmeter.
- It has lowest stability and low voltage output.
- It has non linear scale.
- It has lowest sensitivity.
- Temperature Range - –200 to 1800ºC.

147. Which of the following quantities cannot be measured using a multimeter?

(a) AC Voltage (b) DC Current
(c) Phase Angle (d) Resistance

RRB Chandigarh SSE-15.03.2009

Ans. (c) : Phase angle can't be measured by multimeter however the phase angle between voltage and current can be measured by power factor meter.
Multimeter is also called as VOM meter (Volt-ohm-milliameter).

148. Which of the following type of sensors allow current to flow into the negative (-) supply?

(a) Sourcing sensors
(b) Sinking sensors

(c) Ultrasonic sensors
(d) Photo - optical sensors

UPMRCL JE (S&T) 03.01.2023, 1:30 PM- 3:30 PM

Ans. (b) : Sinking sensors: In a sinking configuration, current passes through the load first through the output switch of the sensor and lastly to ground. It is a transistor logic output that switches the DC ground, or negative, lag of the circuit.

149. Insulation resistance can be measured by:
(a) Ohm meter (b) Multi meter
(c) Earth tester (d) None of these

DMRC JE-2017
LMRC JE-2016
RRB Patna SSE-09.09.2012

Ans. (d) : Insulation resistance is high resistance that can be measured by megger, Mega ohm meter, loss of charge method and direct deflection method.
Medium resistance is measured by ohm meter and multimeter etc.
Earth tester is the instrument that can be used in measurement of earth resistance not in insulation resistance.

150. Which of the following is a digital transducer
(a) Strain Gauge (b) Thermistor
(c) Encoder (d) LVDT

LMRC SC/TO Shift-2 J.E. 2016

Ans : (c) Encoder is a digital transducer, while strain gauge thermistor and LVDT are analog transducer.
• Optical encoder transducers use angular speed measured.

$$\text{Resolution of optical encoder} = \frac{360}{2^n}$$

Where, n = No. of bits

151. Tachymeter (or Tacheometer) is an instrument for measuring–
(a) RPM (b) Torque
(c) Rotational Kinetic energy (d) Distances

RRB SSE Secunderabad Green paper, 21.12.2014

Ans. (a) : Tachymeter (or Tacheometer) is an instrument for measuring RPM.
Tacheometer is type -
(i) Mechanical tachometer
(ii) Electric tachometer.

152. Which of the following is piezoelectric material?
(a) Quartz (b) Silica Sand
(c) Corundum (d) Polystyrene

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans. (a) : Piezoelectric material
→ Quartz
→ Rochelle salt
→ Barium titanate
→ Potassium dehydrogenate phosphate

153. The measurement of the speed of a rotating shaft by means of an electric tachometer is a:
(a) Direct Measurement
(b) Secondary Measurement
(c) Tertiary Measurements
(d) All of these

RRB SSE Secunderabad Red Paper, 21.12. 2014

Ans. (c) : The measurement of the speed of a rotating shaft by means of an electric tachometer is a example of Tertiary Measurements.

Tachometer- Tachometers are generally used to measure the rotation speed (angular velocity) of a shaft or disk in a motor or other machine.

• There are two type of tachometers namely the Fullerton tachometer and frahm tachometer which are used to measure the frequency of the vibrating system.

154. Pirani gauge is useful for measurement of pressure between:

(a) 10^{-1} to 10^{-6} mm of Hg
(b) 10^{-1} to 10^{-12} mm of Hg
(c) 10^{-1} to 10^{-3} mm of Hg
(d) 10^{-1} to 10^{-9} mm of Hg

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
RRB Mumbai JE-19.12.2010

Ans. (c) : Pirani gauge is useful for measurement of pressure between 10^{-1} to 10^{-3} mm of Hg.

• The operation of a Pirani gauge depends on variation of the thermal conductivity of a gas with pressure.

• Pirani gauges are rugged inexpansive and usually more accurate than thermocouple gauges.

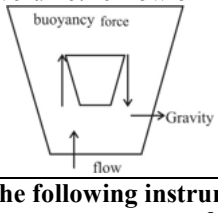
155. Rotameter is an example of:

(a) rotating propeller type flow meter
(b) variable area flow meter
(c) variable head flow meter
(d) drag force flow meter

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM

Ans. (b) : Rotameter is an example of variable area flow meter.

• A rotameter (variable area flow meter) is a flow meter that measures the volumetric flow of liquids and gasses.



156. Which of the following instruments used for maintenance can measure voltage, current, continuity and resistance?

(a) Multimeter (b) Function generator
(c) CRO (d) Megger

RRB Chandigarh SSE-15.03.2009

Ans : (a) A multi tester also known as VOM (Volt - ohm milliammeter) is an electronic measuring instrument.

A multimeter can measure -

1) Voltage
2) Current
3) Resistance
4) Continuity

Multimeter, Ammeter, Voltmeter and ohm meter of all three work does.

157. In a thermocouple temperature transducer, the output voltage is usually measured by–

(a) high resistance ammeter
(b) high resistance voltmeter
(c) high resistance milli-voltmeter

(d) Low resistance voltmeter/ammeter

RRB JE (Shift-I), 29.08.2015

Ans : (c) In a thermocouple temperature transducer the output voltage is usually measured by high resistance milli-voltmeter.

- When two metals having different work functions are placed together, a voltage is generated at the junction. Which is proportional to the temperature. The junction is called a "Thermocouple".

158. Which of the following statement is TRUE about megger?

(a) Megger is used to the measurement of voltage.
(b) Megger is used for the measurement of current.
(c) Megger is used for the measurement of insulation resistance.
(d) Megger is used for the measurement of breakdown voltage of insulation.

RRB Guwahati 2014

Ans : (c) Megger is a measuring instrument used for the measurement of insulation resistance of an electrical system. An electrical system degrades its quality of insulation resistance with time and various environmental conditions including temperature, moisture dust particles and humidity. Its speed lies between 130 rpm to 170 rpm.

159. The Gauge factor of a resistance wire strain gauge, is a measure of

(a) Sensitivity of the gauge
(b) Dynamic range of displacement measure
(c) Resolution
(d) Resistivity

Konkan Railway SSE-2015

Ans. (a) : The gauge factor of a resistance wire strain gauge, is a measure of sensitivity of the gauge. This strain gauge is a passive transducer. The resistance coefficient of strain gauge should be low for good magnitude.

$$\boxed{G = \frac{dR/R}{d\ell/\ell}}$$ Where, G = Gauge factor

$$\boxed{G = 1 + 2\nu + \frac{d\rho/\rho}{d\ell/\ell}}$$

$$\boxed{\nu = -\frac{dD/D}{d\ell/\ell}}$$

$\nu \rightarrow$ new

160. Strain gauge rosettes are used to measure strains when:

(a) the direction of principal stress is known
(b) the direction of hoop stress is not known
(c) the direction of longitudinal stress is not known
(d) the direction of principal stress is not known

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM
RRB Bhubaneswar JE-19.08.2001

Ans. (a) : Strain gauge rosettes are used to measure strains when the direction of principal stress is known.

- The gauge factor in a strain gauge must be high. A large value of gauge factor indicates a large charge in the value of resistance for a particular strain.

- The strain gauge has a low temperature coefficient of resistance. In most of the strain gauge, temperature compensation is provided.

161. Gauge factor of a strain gauge is

(a) unit change in resistance per unit change in length
(b) change in resistance per unit change in length
(c) unit change in length per unit change in resistance
(d) change in resistance divided by total resistance

RRB Allahabad SSE-09.09.2012

Ans. (a) : Gauge factor of strain gauge is unit change

$$\text{Gauge Factor } G_f = \frac{\Delta R / R}{\Delta L / L}$$

162. Which one of the following is used to measure temperature inside a boiler furnace?

(a) Resistance thermometer
(b) Bimetallic thermocouple
(c) Optical pyrometer
(d) Thermistor

RRB Allahabad SSE-09.09.2012

Ans. (c) : Optical pyrometer is used to measure temperature inside a boiler furnace.

- Optical pyrometers operate within the visible spectrum to measure temperature typically in the range from 700ºC to 400ºC by comparing the photometric brightness of the heated object against the brightness of a standard source. Such as an incandescent tungsten filament.

163. Dummy strain gauge is used along with measuring strain gauge to

(a) To compensate for the change caused by change in battery voltage
(b) To compensate for the change caused by humidity variation
(c) To compensate for the change caused by temperature variation
(d) To compensate for the change caused by resistance variation

RRB Allahabad SSE-09.09.2012

Ans. (c) : Dummy strain gauge is used along with measuring strain gauge to compensate for the change caused by temperature variation.

- A dummy strain gauge is used in a quarter bridge strain gauge circuit to compensate for changes in temperature and lead wire resistance.
- The dummy gauge is wind into a Wheatstone bridge on an adjacent arm to active gauge.

164. In a flux meter, the controlling torque is.....

(a) produced by weights attached to the moving coil
(b) produced by spring
(c) not provided at all
(d) provided by crossed coil mechanism

RRB Allahabad SSE-09.09.2012

Ans : (c) The flux meter which is used for measuring the flux of the permanent magnet such type of meter is known as the flux meter. The flux meter is the advanced form of ballistic galvanometer which has certain advantages like the meter has no controlling torque and heavy electromagnetic damping.

165. Which of the following bridges is frequency sensitive?

(a) Wheatstone (b) Maxwells
(c) Andersons (d) Wien

DFCCIL JE-11.11.2018
LMRC SCTO Shift-I–2016
RRB Chennai SSE-09.09.2012

Ans : (d) Wien bridge is frequency sensitive bridge.
The frequency is measured by Wien bridge.

Wien bridge	- Frequency
Anderson bridge	- Low Q inductance
Wheatstone bridge	- Medium resistance
Maxwell bridge	- Medium Q inductance

166. The rotameter is a:

(a) variable-head-variable-area flow meter
(b) constant-area-variable-head flow meter
(c) constant-head-variable-area flow meter
(d) variable-velocity flow meter

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM
RRB Jammu SSE-2013

Ans. (c) : The rotameter is a constant head-variable are flow meter -

- Rotameter is a constant pressure drop variable area flowmeter.
- It measures the flow rate of liquid or gas.
- As area changes there will be a change in the volumetric flow rate.
- No electricity is required.

167. Pirani gauge is used for measuring?

(a) very high pressure
(b) medium pressure
(c) very low pressure
(d) atmospheric pressure

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM
RRB Gorakhpur SSE-09.09.2012

Ans. (c) : Pirani gauge is used for measuring very low pressure.

- Pirani gauge is pressure range is 10^{-1} mm Hg to 10^{-3} mmHg.
- The operation of a pirani gauge depends on variation of the thermal conductivity of a gas with pressure.
- Pirani gauges are rugged inexpansive and usually more accurate than thermocouple gauges.

168. Thermocouples are -

(a) Passive transducers (b) Active transducers
(c) Both (a) and (b) (d) None of these

RRB Kolkata Technical III-20.08.2006

Ans. (b) : When two metals having different work functions are placed together, a voltage is generated at the junction which is proportional to the temperature this junction is called a "Thermocouple".

- Thermocouple works on the principle of seebeck effect.
- It is an active transducer since, no external supply is required for getting the electrical output.
- It is suitable for temperature measurement upto 1400ºC.

169. A thermopile is-

(a) Used to detect thermal radiation
(b) Used to measure heating effect of electric current

(c) A number of thermo-couples joined in parallel
(d) Both (a) & (b)

RRB Kolkata Technical-III, 20.08.2006

Ans. (d) : Thermopiles are used for contactless temperature sensing. The function of a thermopile is to transfer the heat radiation emitted from the object to a voltage output. The output is in the range of tens or hundreds of millivolts Thermopiles work as sensors or generators.

170. Which one of the following transducers can be used for magnetic flux density measurement?

(a) LVDT (b) Synchro
(c) Hall effect transducer (d) Thermocouple

RRB Kolkata Technical-III, 20.08.2006

Ans. (c) : Hall effect transducer can be used for magnetic flux density measurement.

- Hall effect is utilized in determining whether a given material is metal, n-type. Semiconductor, P-type semiconductor.

$$V_H = \frac{BI}{\rho W} = R_H \frac{BI}{W}$$

$$R_H = \frac{1}{\rho} = \frac{1}{n.q} = \frac{1}{pq}$$

171. The operation of a Thermocouple is based on:

(a) Thomson effect (b) Seebeck effect
(c) Peltier effect (d) Faraday's laws

RRB Kolkata Technical-III, 20.08.2006

Ans. (b) The operation of a thermocouple is based on seebeck effect.

- When two metals having different work functions are placed together, a voltage is generated at the junction which is proportional to the temperature. The junction is called a "Thermocouple".
- It is an active transducer since no external supply is required for getting the electrical output.

172. A Piezometer is used to measure

(a) Strain in structure (b) Very low pressure
(c) Very high pressure (d) Leakage reactance

RRB Chennai Technical (Engg.)15.04.2007

Ans. (b) : • A Piezometer is either a device used to measure liquid pressure in a system by measuring the height to which a column of the liquid rises against gravity or a device that measure the pressure (more precisely to piezo metric head) of groundwater at a specific paint.

• A piezometer is designed to measure static pressures and thus differs from a pitot tube by not being painted into the fluid flow.

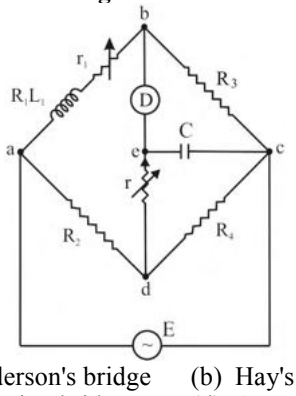
173. Pitot tubes are used to check:

(a) Mass calculation
(b) Air velocity in ducts
(c) Surface temperatures
(d) Measure gases

RRB Chennai Technical (Engg.) 15.04.2017

Ans. (b) : Pitot tubes are used to check air velocity in ducts. Pitot tube is a liquid flow measurement device. It is also known as pitot probe.

174. Identify the bridge network shown.



(a) Anderson's bridge (b) Hay's bridge
(c) Schering bridge (d) Owen's bridge

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM

Ans. (a) : The given bridge network is Anderson's bridge.

- Anderson's bridge measures the precise measurement of inductance of low Q coils.
- Anderson's bridge is a modified form of Maxwell inductance capacitance bridge.

175. LVDT cannot measure :

(a) Weight (b) Pressure
(c) Acceleration (d) Temperature

RRB Patna /Allahabad ESM-III, 30.01.2011

Ans : (d) LVDT can't measure the temperature, but it can measure weight, pressure, acceleration etc.
LVDT stands for "linear variable differential transformer". Generally, LVDT, is a normal type of transducer.

176. Linear variable differential transformer (LVDT) is used for measuring displacement. The principle of working of LVDT is-

(a) Magnetic reluctance (b) Permanence
(c) Mutual induction (d) Self induction

RRB Patna/Allahabad ESM-III,30.01.2011

Ans. (c) : A linear variable differential transformer or LVDT is an electromechanical position transducer (sensor) which provides accurate and frictionless positional feedback information about the linear mechanical position of an external force. It uses basic transformer principles of mutual inductance to measure linear movement as in the working of transformer.

177. Which of the following options is an Active transducer?

(a) Photo emissive cell
(b) Photo voltaic cell
(c) Selsyn
(d) Photo emissive cell, photo voltaic cell and selsyn

RRB Mumbai SSE-05.10.2008

Ans : (b) Active transducer produce an electrical signal proportional to the input i.e. Piezoelectric, thermocouple and photovoltaic cell transducer all are active transducer. Active transducers are self generating type, they don't require external power to work.

178. Which one of the following transducer is made of semiconductor ?

(a) Thermometer (b) Microphone
(c) Thermocouple (d) Thermistor

RRB Mumbai JE-19.12.2010

Ans. (d) : Thermistor are semiconductor sensor which are made from the sintered compound of metallic oxide of Cu, Mn, Ni & Co form beads, rings and disc.

179. Which of the following is not a pressure measurement transducer?

(a) Thermocouple
(b) Strain gauge
(c) LVDT
(d) Piezoelectric transducers

RRB Chennai Technical Engg.15.04.2007

Ans. (a) : Measurement of thermocouple–

- By using a PMMC instrument i.e. a PMMC millivoltmeter.
- After amplification, the output voltage can be measured.

So, thermocouple is not a pressure measurement transducer.

180. The ballistic galvanometer is usually lightly damped so that–

(a) it may oscillate
(b) it may remain stable
(c) amplitude of the first swing is large
(d) amplitude of the first swing is small

LMRC SCTO Shift-I–2016

Ans : (c) Ballistic Galvanometer : The working principle of the ballistic galvanometer is very simple. It depends on the deflecting of coil which is directly proportional to the charge passes through it. The ballistic galvanometer measures the majority of the charge passes through it in spite of current.

181. Capacitive transducers are normally used for –

(a) Static measurement
(b) Dynamic measurements
(c) Both static and dynamic measurements
(d) Transient measurement

RRB Mumbai JE-19.12.2010

Ans. (b) : Capacitive transducers are normally used for dynamic measurements. Capacitive transducers are used for measuring the displacement, pressure and other physical dynamic quantities. Dynamic measurement is done for the quantities which vary quickly with time while static measurement is done for quantities slowly varying with time.

182. For measuring a very high resistance we should use–

(a) Kelvin's double bridge
(b) Wheatstone bridge
(c) Megger
(d) None of these

RRB JE Secunderabad (Shift-I)-18.08.2015

Ans. (c) : For measuring a very high resistance we should use megger. Megger works on the principle of electromagnetic induction. A megger uses PMMC instrument and its operation is based on a moving coil meter.

183. A transducer converts

(a) mechanical energy into electrical energy
(b) mechanical displacement into electrical signal
(c) one form of energy into another form of energy
(d) electrical energy into mechanical form

RRB Mumbai SSE-19.12.2010

Ans. (c) : A transducer converts one form of energy into another form of energy. An electric heater and loudspeaker are examples of transducers. Heater converts electrical energy into heat energy while loudspeaker converts electrical energy into sound energy.

184. Which of the following is not a transducer

(a) Strain Gauge (b) Microphone
(c) Potentiometer (d) Thermocouple

RRB Gorakhpur SSE-09.09.2012

Ans : (c) Potentiometer is not a transducer. Potentiometer is an instrument for measuring an electromotive force by balancing it against the potential difference produced by passing a known current through a known variable resistance.

185. Piezoelectric transducers are.....

(a) Passive transducers
(b) Active transducers
(c) Inverse transducers
(d) Both active transducers and inverse transducers

RRB Chennai Technical Engg. 15.04.2007

Ans : (d) Piezoelectric transducers are devices which are capable of converting electrical quantity to non electrical quantity there are made of quartz, Barium titanate and lead zirconate. These are known as inverse transducers.

186. Hall effect transducers can be used for measurement of.....

(a) Power (b) Current
(c) Displacement (d) All of these

RRB Mumbai SSE- 19.12.2010

Ans : (d) The hall effect element is a type of transducer used for measuring the power, current, displacement and it requires small space and also gives the continuous signal concerning the magnetic field strength.

187. An inverse transducer converts

(a) electrical energy to any other form of energy
(b) electrical energy to light energy
(c) mechanical displacement into electrical signal
(d) electrical energy to mechanical form

RRB Chennai Technical Engg-15.04.2007

Ans. : (a) A transducer is a basically a sensing device that converts the variable of a process from one form to another. This converts the measured physical parameters, ex. pressure, temperature, displacement, torque etc. into their constant measurable electrical quantities that inverse electrical quantities is converted displacement, pressure, force, temperature etc is called inverse transducer.

188. A strain gauge is a passive transducer and is employed for converting

(a) Pressure into change in resistance
(b) force into displacement
(c) mechanical displacement into a change of resistance
(d) None of the above

RRB Chennai Technical Engg-15.04.2007

Ans. : (c) The strain gauge is one of the most important sensor of the electrical measurement technique applied to the measurement of technical quantities. It converts force, pressure, tension, weight etc, into a change in electrical resistance which can then be measured.

189. Synchro is :

(a) Parabolic transducer
(b) An angular position transducer
(c) A synchronizing transducer
(d) A variable transducer

RRB Mumbai SSE-19.12.2010

Ans. : (b) Synchro: The synchro is a type of transducer which transformed the angular position of the shaft into an electrical signal. It is used as an error detector and as a rotary position sensor. The error occurs in the system because of the misalignment of the shaft.

190. What is the order of minimum displacement that can be measured with capacitive transducers?

(a) 1 mm (b) 1 μm
(c) 1×10^{-12}m (d) 1cm

RRB Mumbai SSE-19.12.2010

Ans: (b) The order of minimum displacement of a capacitive transducer is upto 1μm.

191. Wheatstone Bridge is best suited for measurement of :

(a) Low resistances
(b) Medium resistances
(c) High resistances
(d) Insulation resistance of cables

UPPCL JE Electrical, 11.11.2016
RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (b) Wheatstone bridge is best suited for measurement of medium resistances.

Measurement of medium resistance -

- Wheatstone bridge method
- Substitution method
- Ohmmeter method
- Voltmeter-Ammeter method

192. ..... is an example of piezoelectric material :

(a) Class (b) Quartz
(c) Corundum (d) Neoprene

(RRB SSE Bilaspur Yellow paper, 21.12.2014)

Ans : (b) Piezo- electric materials are materials that produce an electric current when they are placed under mechanical stress. The piezo-electric process is also reversible. Quartz is the best example of piezoelectric material.

193. The measurement of the speed of a rotating shaft by means of an electric tachometer is a:

(a) Direct Measurement
(b) Secondary Measurement
(c) Tertiary Measurements
(d) All of these

(RRB SSE Secunderabad Red Paper, 21.12. 2014)

Ans : (c) The measurement of speed of rotating shaft by an electric transducers is the example of tertiary measurement. When measuring process involves two conversion then its called tertiary measurement.

194. Kelvin double bridge in its basic form is used to measure:

(a) very high resistance
(b) very low resistance

(c) very high capacitance
(d) very low capacitance

RRB JE 30.08.2019, Shift-II
BMRCL JE-24.02.2019

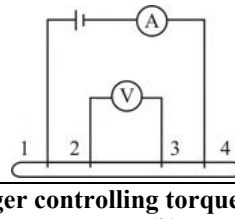
Ans. (b) : Kelvin double bridge in its basic form is used to measure very low resistance.

- Kelvin double bridge is a modified form of Wheatstone bridge, which is used to measure lower resistance value in the 1 to .00001 ohm's.
- While measuring low resistance value the contact and lead resistance cause significant error in reading, hence in order to overcome this error Kelvin double bridge is used.

195. Four terminal approach is used in measuring low resistance because it
(a) eliminates thermoelectric energy
(b) eliminates stray capacitance
(c) eliminates stray inductance
(d) eliminates the effect of leads and contacts

RRB JE 31.08.2019

Ans. (d) : Four terminal approach is used in measuring low resistance because it eliminates the effect of leads and contacts.



196. In a megger controlling torque is provided by–
(a) spring (b) gravity
(c) coil (d) eddy current

LMRC SCTO Shift-I–2016
RRB JE Secunderabad (Shift-I), 18.08.2015

Ans : (c) In a megger controlling torque is provided by coil.

- Megger works on the principle electromagnetic induction.
- Electrical power for a megger is provided by permanent magnet DC generator.
- It is used to measure high resistance, earth continuity, insulation test, Earth and ground test.

197. Electric power for a megger is provided by :
(a) Battery
(b) Permanent magnet DC generator
(c) AC generator
(d) AC or DC

RRB JE Secunderabad (Shift-I), 18.08.2015

Ans : (b) Electric power for a megger is provided by permanent magnet DC generator.

- There are no need of external supply.
- It works on the principle of electromagnetic induction.
- Speed of megger should be 160 rpm.
- Deflection $(\theta) \propto \dfrac{1}{\text{Unknown resistance}\,(R_T)}$
- A megger is used for measurement of high value resistance.

198. The operating voltage of a megger is about-

(a) 6 V (b) 12 V
(c) 40 V (d) 100 V

RRB JE Secunderabad (Shift-I), 18.08.2015

Ans : (d) The operating voltage of a megger is about 100V and speed 160 rpm.

- It works on the principle of electromagnetic induction.
- Electrical power for megger is provided by permanent magnet DC generator.

199. How much accuracy can be obtained using Wien's bridge?

(a) 0 - 0.5% (b) 0.2 - 0.3%
(c) 0.5 - 1% (d) 1 - 1.5%

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (a) : The wien's bridge use in AC circuits for determining the value of unknown frequency. The bridge measures the frequencies from 100Hz to 100 kHz. The accuracy of the bridges lies between 0.1 to 0.5 percent.

200. Schering bridge is used to measure

(a) Frequency (b) Inductance
(c) Capacitance (d) Mutual Inductance

RRB JE- 01.09.2019
DMRC Electronic, 2014

Ans : (c) Schering bridge : It is one of the most important A.C. bridge, widely used for the measurement of unknown capacitors, dielectric loss and power factor. The Schering bridge is widely used for testing small capacitors at low voltage with very high precision.

201. Inductance is measured by

(a) Wien bridge (b) Maxwell bridge
(c) Schering bridge (d) Owen bridge

DMRC 23.02.2020, Shift-I

Ans. (b) :

Bridge	Measurement
Maxwell bridge	measures inductance
Wien bridge	Measures audio frequencies
Schering bridge	Measures capacitance and dielectric loss
Owen bridge	Measures self inductance with a wide range.

202. A vibration galvanometer is used as a detector in a :

(a) high voltage Schering bridge
(b) low voltage Schering bridge
(c) Wheatstone bridge
(d) Maxwell bridge

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM
LMRC JE (S&T) 12.05.2018

Ans. (a) : Vibration galvanometer- It is used to detect alternating current at the frequency of its natural resonance. The sharp resonance of a vibration galvanometer is very sensitive to change in the measured current and frequency, and can be used as a precisely tunned device vibration galvanometer is used as a detector in high voltage Schering bridge.

13.

- **1-bit = 1/0**
- **1-nibble = Group of 4-bit**
- **1-byte = 8-bit = 2-Nibble**
- **1-kB = 1024-byte = 2^{10}-byte**
- **1-MB = 1024 kb = 2^{20}-byte**
- **1-GB = 1024 MB = 2^{30}-byte**
- **1-TB = 1024 GB = 2^{40}-byte**

❑ Computer languages

1. Machine language-

- A program written in terms of 1′s & 0′s is called machine language
- It is very fast
- It is machine dependent
- In machine language, it is difficult to modify errors

2. Assembly language-

- If a program is written in English then like those word is called mnemonics and the language is called assembly language

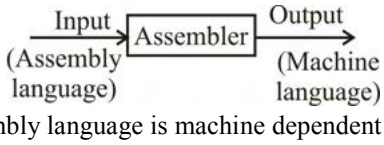
Ex. MOV, MVI, LDA etc

3. High level language-

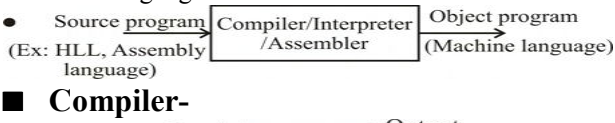
- HLL is machine independent language

Ex. C, C^{++}, JAVA, COBOL, FORTRAN etc.

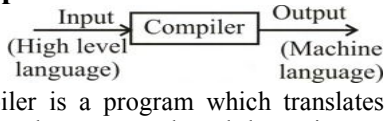
■ Assembler-



- Assembly language is machine dependent language
- Machine language and Assembly language are low level language



■ Compiler-



- Compiler is a program which translates HLL into machine language and read the entire program then execute.
- It is faster than interpreter.

■ Interpreter-

- Interpreter which translate the HLL into machine language execute it and read one statement at a time and then goes to next statement of the program.
- It is occupied less memory space than compiler.

Loader	The loader is a program that load the secondary memory of program into the main memory.
Linker	A linker is a special program, which links (combined) a small program as for single program.

Microprocessor

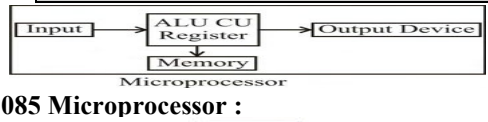
Firmware	A software program is stored in a ROM that can not be changed is known as firmwave.
Hardware	Physical components of systems are called Hardware
Program	Set of instruction
Software	Group of program
Instruction	It is a binary pattern.

❑ Microprocessor

Microprocessor	Word length	Memory capacity
Intel 4004 (PMOS)	4-bit	640 B
Intel 8008 (NMOS)	8-bit	16 KB
Intel 8080 (NMOS)	8-bit	64 KB
Intel 8085 (NMOS)	8-bit	64 KB
Intel 8086 (HMOS)	16-bit	1 MB
Intel 8088 (HMOS)	8/16-bit	1MB
Intel 80186(HMOS)	16-bit	1 MB
Intel 80286(HMOS)	16-bit	16 MB real, 4 GB Virtual
Intel 80386(HMOS)	32-bit	4 GB real, 4 GB Virtual
Intel 80486(HMOS)	32-bit	4 GB real, 64 TB Virtual
Pentium-II	64-bit	64 GB Real
Z-80	8-bit	64 KB
Z-800	8-bit	500 KB

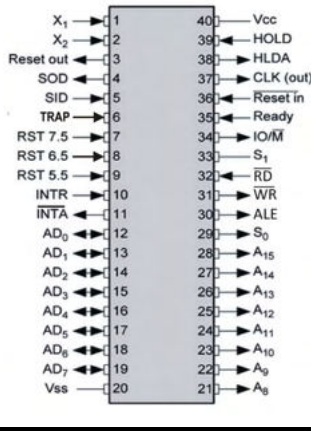
NOTE

- A microprocessor is a multipurpose clock driven, register based electronics device.
- Microprocessor contains ALU, control units and register of a CPU in a single package.
- Instruction set of 8080+RIM+SIM= Instruction set of 8085.
  First microprocessor which support the secondary memory (hard disk) is a Intel 80286



Microprocessor

■ **8085 Microprocessor :**



- It is 8 bit processor (e.g. word length = 8 bit)
- It is manufactured from NMOS technology
- Address bus : It is unidirectional (16 bit address line)
- Data bus : It is bidirectional (8 bit data bus line)
- Maximum memory that can interface with 8085 = 65536 bytes (64 K bytes)
- AD_7–AD_0→Multiplexed address and data bus
- A_{15} - A_8 → Address bus
- Clock frequency is 3 MHz
- It can access up to 64 KB
- 40 Pins (DIP) IC package
- No. of output pin/outward pin - 27
- No. of input pin/inward pin - 21
- Lower address line & data line is multiplex by TDM (Time division multiplexing)
- % of duty cycle = 50%
- It is operated with single +5V supply.

- **System bus-**
- Bus is group of conductor (or wire)
- System bus are three types-

1. **Address bus-**

- It consists of group of 16-wires, defined as A_0–A_{15}.
- It is unidirectional, which means that information flow only from microprocessor to memory or microprocessor to input device.
- It defines the memory handling capacity of microprocessor.

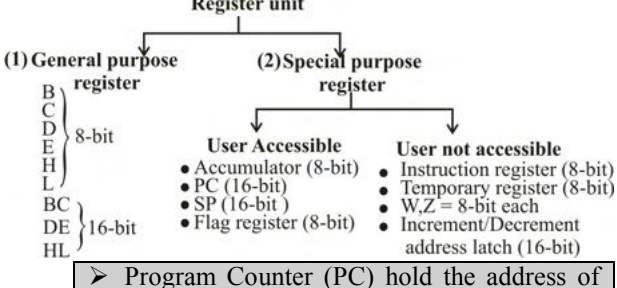
2. **Data bus-**

- AD_7- AD_0 are bidirectional they are used as the lower order address bus as well as the data bus.
- It is consists of group of 8-wires, from D_0–D_7 terminals.
- It is bidirectional, which means that information flows between microprocessor to memory, microprocessor to input devices, memory to microprocessor. Input device to microprocessor.

3. **Control bus-**

- It is consists of single line which are used to control the information from microprocessor to peripherals or from peripherals to microprocessor.
- The control bus array and control signal are partially unidirectional or partially bidirectional.

■ **Classification of Register in 8085 microprocessor**



- Program Counter (PC) hold the address of next instruction to be executed.
- Stack Pointer (SP) is a 16-bit register which is used to point the top of stack memory (or hold the address of top of stack memory).
- Stack memory is the part of RAM, which is used to store the temporary data and the content of program counter when sub-routines are used.

- Stack is operates on the principle of LIFO (Last In First Out).
- Instructions Register (IR) hold the operation code (Opcode) of the instruction which the microprocessor is currently executed.
- IR, loaded during opcode fetch cycle.
- ALU = Accumulator+ Temporary register + 5-flags and Arithmetic and logical circuit.

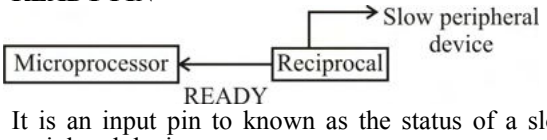
IO/$\overline{M}$	$\overline{RD}$	$\overline{WR}$	Operation
0	0	1	Memory read $(\overline{MEMR})$
0	1	0	Memory write $(\overline{MEMW})$
1	0	1	I/O Read $(\overline{IOR})$
1	1	0	I/O Write $(\overline{IOW})$

- **Status Pin (S_1,S_0)**
- These are the status line which indicate the status of the operation.

S_1	S_0	Operation
0	0	HALT
0	1	Write
1	0	Read
1	1	Fetch

IO/$\overline{M}$	S_1	S_0	Operation
(Hi-Z)	0	0	HLT
0	0	1	Mem. Write
0	1	0	Mem. Read
1	0	1	IO Write
1	1	0	IO Read
0	1	1	Fetch
1	1	1	$\overline{INTA}$

- **ALE (Address Latch Enable)-**
- If ALE = 1, then AD_0-AD_7=A_0-A_7
- If ALE = 0, then AD_0-AD_7=D_0-D_7
- **READY PIN-**



- It is an input pin to known as the status of a slow peripheral device
- If the signal at the ready pin is low, then the microprocessor inter into a wait state T_2 and T_3.
- READY pin introduce wait state
- READY pin signal is used to synchronize slow peripheral device with microprocessor

■ **Power supply and clock frequency:**

V_{cc}	+5V Power supply.
V_{ss}	Ground reference.
X_1, X_2	A crystal oscillator is connected at these two pins. The frequency is internally divided by two using one T flip-flop therefore, To operate a system at 3MHz the crystal oscillator should have frequency of 6 MHz.
CLK (OUT)	This signal can be used as the system clock for other device.

■ **Interrupt signals :**

- **Software interrupt :**

Interrupt	Address	Interrupt	Address
RST0	0000 H	RST 4	0020 H
RST 1	0008 H	RST 5	0028 H
RST 2	0010 H	RST 6	0030 H
RST 3	0018 H	RST 7	0038 H

- **Hardware Interrupt -**

Interrupt	Triggering	Vectored/Non-Vectored Address	Maskable/ Non - Maskable	Address
TRAP	Edge and level	Vectored	Non - Maskable	0024H
RST 7.5	Edge	Vectored	Maskable	003CH
RST 6.5	Level	Vectored	Maskable	0034H
RST 5.5	Level	Vectored	Maskable	002CH
INTR	Level	Non-Vectored	Maskable	0000H-0038H

- TRAP is highest priority among all the interrupts.
- TRAP is also called as RST 4.5 interrupt.
- Priority order of interrupts are – TRAP > RST 7.5 > RST 6.5 > RST 5.5 > INTR
- No. of hardware interrupt = 5
- No. of software interrupt = 8
- Total no. of interrupt in 8085 = 13

■ **Reset signals :**

RESET IN	When the signal on this pin is low (0). the program counter is set to zero, the buses are tri-state and the microprocessor unit is reset. Program Counter = 0000H
RESET OUT	This signal indicates that the microprocessor is being reset. The signal can be used to reset other device.

■ **DMA Request signal**

HOLD	Hold is an active high input signal that is used by another controller to request microprocessor to use address, data and control signal.
HLDA	It is a signal which indicates that the hold request has been received after the removal of a HOLD request, the HLDA goes low.

■ **Serial I/O Ports :** Serial transmission in 8085 is implemented by the two signals.

- **SID and SOD :** SID is a data line for serial input where as SOD is a data line for output.

NOTE

SID & SOD are internally connected to D_7 bit of accumulator.

■ **Some important instruction of 8085 -**
The 8085 microprocessor has 74 basic instruction and 246 total instruction.

- The instruction word size of 8085 microprocessor can be one-byte, two-byte and three-byte.
- Different phases in execution process:

Input → Fetch → Decoder → Execution → Output

- **T-state:**
- T-state is the time period of a single clock of the clock frequency.
  - Op-code fetch→4T/6T
  - I/O read→3T
  - Memory read→3T
  - I/O write→3T
  - Memory write →3T
  - Bus Idle machine cycle→3T
  - Interrupt acknowledge cycle→3T

Special fetch cycle (6T)

C→ CALL, RET R→ RST

I→ INX, DCX S→ SPHL, PCHL P→ PUSH

- **Machine cycle**
- The no. of T-state required to access a peripheral is called a machine cycle.
- Machine cycle may be consists of 3 to 6-T state.
- **Instruction cycle (IC)**
- Total no. of machine cycle required to fetch and execute an instruction is called IC

$$\text{I.C.} = \text{Fetch cycle} + \text{Execute cycle}$$

- Instruction cycle consists of one to five machine cycles.
- Maximum T-state (18-T) required for CALL instruction.

There is no separate instruction for multiplication and division in 8085.

- **Addressing Mode**
- The technique of specified the address of data is known as addressing mode.
- **Type of addressing mode**

Register addressing mode	Instruction specified the name of register (GPR) in which data is available.
Immediate addressing mode	The operand (or data) is given in the instruction. Ex.- MVIA, 34H,CALL, JMP etc.
Direct addressing mode	The address of data is specified in the instruction. Ex.- LDA, STA, IN, OUT, LHLD, SHLD etc.
Indirect addressing mode	The instruction specified the name of register pair in which the address of data is available. Ex.- LDAX, MOVA, M, PUSH, POP etc.
Implicit addressing mode	The instruction itself specified the data to be operated. Ex.-CMA, RAR, CMC, STC, PCHL, SPHL, DAA etc.

❑ Instructions set

Instructions	Byte	Machine cycle	T-State	
				S
MOV R, R	1	1; F	4	
MOV R, M	1	2; FR	7	
MOV M, R	1	2; FW	7	
MVI R, data	2	2; FR	7	
LXI rp, 16 bit data	3	3; FRR	10	
LDA address	3	4; FRRR	13	
STA address	3	4; FRRW	13	
LHLD address	3	5;FRRRR	16	
SHLD address	3	5; FRRWW	16	
LDAX rp	1	2; FR	7	
STAX	1	2; FW	7	
XCHG	1	1; F	4	
MVI M, data	2	3; FRW	10	
ADD R / ADC R	1	1; F	4	√
ADD M / ADC M	1	2; FR	7	√
ADI data	2	2; FR	7	√
SUB R / SSB R	1	1;F	4	√
SUB M / SSB M	1	2;FR	7	√
SUI data	2	2; FR	7	√
INR R	1	1;F	4	√
INR M	1	3; FRW	10	√
INX rp	1	1;SF	6	
DCR R	1	1;F	4	√
DCR M	1	3;FRW	10	√
DCX rp	1	1; SF	6	
DAA	1	1;F	4	√
DAD rp	1	3;F+2BI	10	
ANA R	1	1;F	4	√
ANA M	1	2;FR	7	√
ANI data	2	2; FR	7	√
ORA R	1	1;F	4	√
ORA M	1	2;FR	7	√
ORI data	2	2;FR	7	√
XRA R	1	1;F	4	√
XRA M	1	2;FR	7	√
XRI data	2	2;FR	7	√
CMA	1	1;F	4	
CMP R	1	1;F	4	√
CMP M	1	2;FR	7	√
CPI data	2	2;FR	7	√
CMC	1	1; F	4	
STC	1	1;F	4	
RLC/ RCC /RAL/RAR	1	1;F	4	
JMP	3	3;FRR	10	
Conditional JMP				
Condition met	3	3;FRR	10	
Condition not met	3	2;FR	7	
PCHL	1	1;SF	6	
CALL	3	5;SFRRWW	18	

Flag affected					Addressing mode
	Z	P	AC	CY	
×	×	×	×	×	Register
×	×	×	×	×	Register indirect
×	×	×	×	×	Register indirect
×	×	×	×	×	Immediate
×	×	×	×	×	Immediate
×	×	×	×	×	Direct
×	×	×	×	×	Direct
×	×	×	×	×	Direct
×	×	×	×	×	Direct
×	×	×	×	×	Register indirect
×	×	×	×	×	Register indirect
×	×	×	×	×	Implicit
×	×	×	×	×	Register indirect/ Immediate
✓	✓	✓	✓	✓	Register
✓	✓	✓	✓	✓	Register indirect
✓	✓	✓	✓	✓	Immediate
✓	✓	✓	✓	✓	Register
✓	✓	✓	✓	✓	Register indirect
✓	✓	✓	✓	✓	Immediate
✓	✓	✓	✓	×	Register
✓	✓	✓	✓	×	Register indirect
×	×	×	×	×	Register
✓	✓	✓	✓	×	Register
✓	✓	✓	✓	×	Register indirect
×	×	×	×	×	Register
✓	✓	✓	✓	✓	Implicit
×	×	×	×	✓	Register
✓	✓	✓	1	0	Register
✓	✓	✓	1	0	Register indirect
✓	✓	✓	1	0	Immediate
✓	✓	✓	0	0	Register
✓	✓	✓	0	0	Register indirect
✓	✓	✓	0	0	Immediate
✓	✓	✓	0	0	Register
✓	✓	✓	0	0	Register indirect
✓	✓	✓	0	0	Immediate
×	×	×	×	×	Implicit
✓	✓	✓	✓	✓	Register
✓	✓	✓	✓	✓	Register indirect
✓	✓	✓	✓	✓	Immediate
×	×	×	×	✓	Implicit
×	×	×	×	✓	Implicit
×	×	×	×	✓	Implicit
×	×	×	×	×	Immediate
×	×	×	×	×	Immediate
×	×	×	×	×	Immediate
×	×	×	×	×	Implicit
×	×	×	×	×	Immediate

Conditional CALL				
Condition met	3	5; SFRRWW	18	
Condition not met	3	2;SFR	9	
RET	1	3; FRR	10	
Conditional RET				
Condition met	1	3;SFRR	12	
Condition not met	1	1;SF	6	
RST n	1	3;SFWW	12	
PUSH rp	1	3; SFWW	12	
POP rp	1	3; FRR	10	
SPHL	1	1;SF	6	
XTHL	1	5;FRRWW	16	
IN port address	2	3;FI/O Read + I/O Read	10	
OUT port address	2	3;FI/O Read + I/O Write	10	
HLT	1	1;F	5	
NOP	1	1;F	4	

- **Register in 8085-** In 8085 microprocessor according to size, there are two types of registers.
- **1 byte register-** In 8085 the 8-bit register can store 8-bit data. B,C,D,E,H,L are 8-bit register & it can be used by programmer.
- **2 byte register-** In 8085 microprocessor there are 16-bit register, 16-bit address of the memory location. BC, DE, HL, SP, PC are 16-bit register in 8085 microprocessor.
- **Stack pointer (SP) (16-bit)** - Stack pointer contains the address of data present at the top of stack.
- **Program counter (PC) (16-bit)**- Program counter contains the address of next instruction which to be executed.
- **Temporary Register (8 bit) -** W, Z.
- **Instruction Register (8 bit)** - It contains opcode of the present instruction.

Stack :-

- Part of read/write (RAM) memory.
- Use to store temporary data and also contained of PC when subroutines are used.
- Technique involved in stack for 8085 is LIFO (Last in first out).

ALU :-

- Accumulator + Temporary register + 5 Flag register + Arithmetic and logic unit (ALU).

It is an 8-bit register having 1-bit.

- Sign (S)
- Parity (P)
- Zero (Z)
- Carry (CY)
- Auxiliary Carry (AC)

Its bit position are -

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
S	Z	×	AC	×	P	×	CY

Sign Flag (S) -

S = 1; When content of D_7 bit of accumulator is one.
S= 0; When content of D_7 bit of accumulator is zero.

×	×	×	×	×	Immediate
×	×	×	×	×	Immediate
×	×	×	×	×	Implicit
×	×	×	×	×	Implicit
×	×	×	×	×	Implicit
×	×	×	×	×	Implicit
×	×	×	×	×	Register indirect
×	×	×	×	×	Register indirect
×	×	×	×	×	Implicit
×	×	×	×	×	Implicit
×	×	×	×	×	Direct
×	×	×	×	×	Direct
×	×	×	×	×	Implicit
×	×	×	×	×	Implicit

Zero Flag (Z) -
Z = 0; If the content of accumulator is non-zero.
Z = 1; If the content of accumulator is zero.
Auxiliary Flag (AC) -
AC = 1; If there is a carry from D_3 bit to D_4 (lower nibble to higher nibble).
AC = 0; otherwise.
Parity Flag (P) -
P = 1; If number of binary 1's in accumulator is Even.
P = 0; If number of binary 1's in accumulator is Odd.
Carry Flag (CY) -
CY = 1; If carry is generated.
CY = 0; If carry is not generated.

NOTE

Auxiliary carry flag is used by only microprocessor.

PSW (Program/Processor Status Word)

PSW (16 bit) ⇒ Accumulator + Flag register

- **Comparison between Memory Map I/O and peripheral Map I/O-**

Characteristics	Memory Map I/O	Peripheral Map I/O
Device address	16-bit	8-bit
Control signal	$\overline{MEMR}$, $\overline{MEMW}$	$\overline{IOR}$, $\overline{IOW}$
Instruction available	MOV, STA, LHLD etc.	Only IN & OUT
Data Transfer	Between any register and I/O	Only between I/O & Accumulator
Maximum no. of I/O device	65536 (64 K)	256 input or 256 output
Hardware requirement	More hardware is needed	Less hardware is needed

Important IC

- **IC 8051**→ Microcontroller
- **IC 8255**→ PPI (Programmable Peripheral Interfacing)
- **IC 8259**→ PIC (Priority Interrupt Controller)
- **IC 8279**→ Keyboard
- **IC 8253/8254** → Programmable Timer
- **IC 8237/8257** → DMA controller
- **IC 8251**→ USART
- **IC 8250**→ UART

NOTE

IC 8251 is used for serial communication

IC 8237/8257 (DMA Controller)

- DMA controller is used for data transfer between memory to I/O without microprocessor
- It operates in 3-modes

1. Burst or Block transfer DMA

- In burst mode, a whole block of data is shared in one contiguous sequence.
- It is fastest DMA mode
- It provides the CPU inactive for associatively long periods speed of microprocessor is reduce.

2. Single Byte Transfer DMA

- In this mode single byte will be transfer in a single hold operation.
- It is slower than block transfer DMA but the microprocessor instruction executed speed is faster.

3. Cycle stealing or Transparent Mode DMA

- It is slowest mode.

IC 8253/8254 (Programmable Timer)

- It has 24 pin DIP
- IC 8254 3-counter
- A_1, A_0 (internal pin of 8254)

A_1	A_0	Selection
0	0	Counter-0
0	1	Counter-1
1	0	Counter-2
1	1	Control register

Application

- Generate an accurate time delay
- Square wave generator
- Rate Generator
- Digital one shot

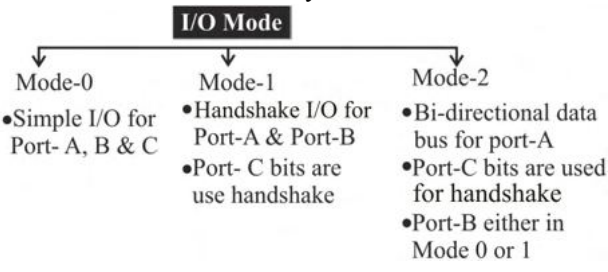
IC 8255 (Programmable Peripheral Interfacing)

- It is general purpose programmable I/O device
- It is 40 pin DIP
- It has 8-bit data bus (D_0-D_7)
- It has three ports, i.e. Port-A, Port-B and Port-C
- A_0, A_1 is control signal pin.

$\overline{CS}$	A_1	A_0	Selection
0	0	0	Port-A
0	0	1	Port-B
0	1	0	Port-C
0	1	1	Control register

- 8255 has two mode of operation
  (a) BSR (Bit Set Reset) mode
  (b) I/O (Input Output) mode

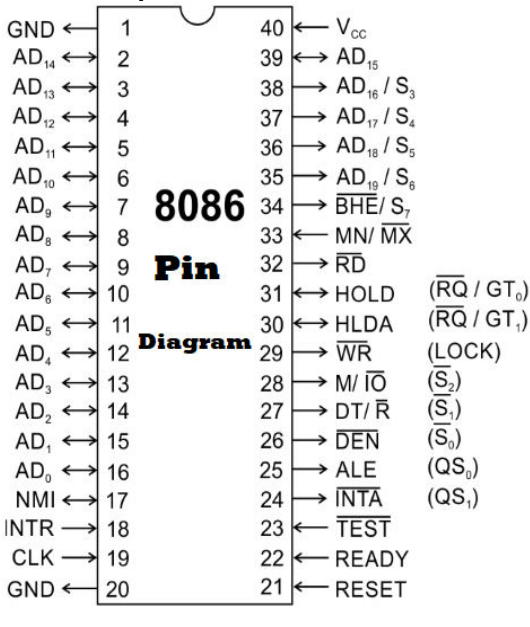
- BSR mode is related only with 8-bits of Port C



- **Comparison between RISC and CISC**

Reduce instruction set computer	Complex instruction set computer
Less instruction	More instruction
Less addressing mode	More addressing mode
More general purpose register	Less general purpose register
Faster	Slower
Instruction executed in one CLK period	Instruction executed more than one CLK period
Cache is more	Cache is less
Register to register operation only	Register to register, register to memory & register to I/O

- **8086 Microprocessor**



- It is a 16-bit processor or 16-data lines.
- It has 20 address lines .
- In 8086 microprocessor we use H-MOS technology.
- Clock frequency is 5MHz to 10 MHz.
- For 8086, A_0-A_{15} are multiplexed with D_0-D_{15} to form AD_0-AD_{15}.
- For 8086, 16 bit data bus D_0-D_{15} (multiplexed as AD_0-AD_{15})

- Higher order address line (A_{16}-A_{19}) are also multiplex with status signal.
- It can access up to 1 MB.
- It has 40 pin DIP
- +5 Volt power supply
- Percentage of duty cycle is 33.33%
- 8086 microprocessor provides fourteen, 16-bit register.
- 8086 microprocessor uses pipelining.
- To speed the execution, 8086 microprocessor includes two processing unit called

(1) Bus interface unit (BIU)
(2) Execution unit

- BIU fetch the instruction and put them in a Queue and the execution unit continuously execute them unit the queue is empty.
- Queue operate on the principle of FIFO

Pipelining

- Fetching of the next instruction while the current instruction is being executed is called pipelining.
- Pipeline technique, improves the maximum clock frequency.
- 8086 microprocessor can pre-fetch to six instruction byte from the memory.

- **Flag Register**

- It is a 16-bit register having 1-bit.
- Overflow (O) Flag
- Direction (D) Flag
- Interrupt (I) Flag
- Trap (T) Flag
- Sign (S) Flag
- Parity (P) Flag
- Zero (Z) Flag
- Carry (CY) Flag
- Auxiliary Carry (AC) Flag
- Its bit position are -

D_{15}	D_{14}	D_{13}	D_{12}	D_{11}	D_{10}	D_9	D_8	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
×	×	×	×	O	D	I	T	S	Z	×	AC	×	P	×	CY

Overflow Flag (O) -
O = 1; If overflow is occurs.
O = 0; If overflow is not occurs.

Direction Flag (D) -
D = 1; Auto decrement.
D = 0; Auto increment.

Interrupt Flag (I) -
I = 1; Enable interrupt.
I = 0; Disable interrupt.

Trap Flag (T) -
T = 1; Perform single stepping.
T = 0; Do not perform single stepping.

Sign Flag (S) -
S = 1; When content of D_7 bit of accumulator is one.
S= 0; When content of D_7 bit of accumulator is zero.

Zero Flag (Z) -
Z = 0; If the content of accumulator is non-zero.
Z = 1; If the content of accumulator is zero.

Auxiliary Flag (AC) -
AC = 1; If there is a carry from D_3 bit to D_4 (lower nibble to higher nibble).
AC = 0; Otherwise.

Parity Flag (P) -
P = 1; If number of binary 1's in accumulator is Even.
P = 0; If number of binary 1's in accumulator is Odd.
Carry Flag (CY) -
CY = 1; If carry is generated.
CY = 0; If carry is not generated.

❑ Important Pins of 8086:

GND (Pin 20 & Pin 1)	There are two pins connected to ground
V_{CC} (Pin 40)	This pin is connected to power supply +5V DC.
RESET (Pin-21)	This is active high input signal to reset the system.
READY (Pin 22)	This is an active high input signal indicating that peripheral is ready.
$AD_0 – AD_{15}$	Bidirectional latched address data lines.
$AD_{16} – AD_{19}$	Higher order address bus
$\overline{RD}$	This is an active low output signal used for read operation
$\overline{BHE}/S_7$	Bus high enable/ status.
$MN/\overline{MX}$	This pin decide whether the processor is operating in minimum mode or maximum mode
NMI	Non- maskable interrupt request.
$\overline{TEST}$	It is an active low signal when it is low microprocessor continues execution and when it is high microprocessor goes to wait state.
Pin 2 to pin 6	There are status signals multiplexed with higher order of address line.

- **Operating modes of 8086**

(i) MN or Min mode:
- In this 8086 is the only processor in the system. In a minimum mode 8086 system
- 8086 is operated in minimum mode when MN/MX' pin to logic 1.

(ii) MX or Max mode:
- 8086 max mode is basically for implementation of allocation of global resources and passing bus control to other coprocessor (i.e. second processor in the system), because two processors can not access system bus at same instant.

(1) Addressing mode of 8086-

- **Immediate addressing mode:** In this mode the operand is specified in the instruction itself e.g. MOV BX, 3598H.
- **Direct Addressing Mode:** In this mode offset is given in the instruction as an 8 bit or 16 bit displacement. e.g. ADD BL, [0103]

- **Register Addressing Mode:** In this mode the operand is placed in one of 8 bit or 16-bit general purpose register. eg. MOV, AX, CX;
- **Register Indirect Addressing:** The operand offset is placed in one of the register such as BX, Base pointer, source index or destination register. e.g. MOV, BX.
- **Register Relative Addressing mode:** The operand offset is the sum of 8 bit or 16-bit displacement and the content of base register or base pointer eg. MOV, CL, [BX + 05H]
- **Based Index Addressing Mode:** The operand offset is the sum of content or base register and indexed register.
  offset = [B or BP] + [SI or DI]
  e.g. ADD CX, [BX + SI]
- **Relative Based Indexed Addressing Mode:** In this mode operands offset is given as offset = base register + indexed register + 8 bit or 16 bit displacement
  e.g. MOV AX, [BX + SI + 1234H]

2. Data copy/Transfer instruction:

- **PUSH Source:** Move the content from source to stack memory. Source can be register, segment register or memory. e.g. PUSH DS
- **POP Destination:** Move the content from the top of stack to destination. Destination can be register, segment register or memory.
  e.g. POP [5000H]
- **MOV Destination, Source:** Source can be register, memory location or immediate data.
  e.g. MOV CX, [037A H]
  MOV BX, [0301H]

3. Arithmetic instruction:

- **ADD Destination, Source:** Add the content of the source to destination and result is kept in destination AX is default register.
- **ADC Destination source:** Similar to ADD but adds content of carry flag also.
- **MUL, Source:** Multiplies the content to the source and content of register A

Example: MUL CL (Multiplies AL & CL)

- **DIV Source:** Divides the content of AL/AX register by content of source.

Example: DIV, CX
DIV, [BX]

- **SUB Source:** Subtracts the content of source from AX/AL.

Example: SUB AX, CX

4. **Logical Instruction:** Logical instruction in 8086 includes AND, OR, XOR, NOT, other logical instruction are rotate instruction and shift instruction.
5. **Branching Instructions:** Branching instruction includes JMP, Conditional Jump, CALL, RET.
6. **Interrupt Instruction:** Interrupt instruction includes instruction for software interrupt.
7. **LOOP Instruction:** These can be conditional or unconditional loop

Example: LOOP, LOOPZ, LOOPNZ.

- **There are 9 flags in 8086**

☞ Data (Status) flags → S, Z, AC, P, CY, O
Control flags → D, I, T

- **Register of 8086**

General purpose register : AX, BX, CX, DX Pointer and index register : SP, BP, SI, DI, IP Segment register : CS, DS, SS, ES

- Accumulator (AX) Base Register (BX)
  Counter Register (CX) Data Transfer Register (DX)
  Stack Pointer (SP) Base Pointer (BP)
  Source Index (SI) Destination Index (DI)
  Code Segment Register (CS)
  Instruction Pointer (IP)
  Data Segment Register (DS)
  Stack Segment Register (SS)
  Extra segment Register (ES)

■ **Interrupt in 8086**

➢ Total interrupt of 8086 microprocessor is 256 and such as:
Type 0 : Divide by zero interrupt
Type 1 : Single stepping interrupt
Type 2 : NMI
Type 3 : Break point interrupt
Type 4 : Over flow interrupt
|
|
|
Type 255:

➢ **Priority of Interrupt**

Divide by zero>NMI>INTR>Single step interrupt

EXAM POINTS

■ The content of accumulator of 8085 microprocessor after the execution of XRI F0 H instruction is– **Complement the upper four bits of the accumulator in 8085**

■ The content of the accumulator of 8085 μP after execution XRI 0F H instruction is - **Only the lower nibble is reset to zero**

■ The transfer of a block of data from one set of memory address to another takes place in - **Block transfer mode**

■ The language which uses mnemonic OP codes- **Assembly language**

■ An interrupt in which the external device supplies its address as well as the interrupt request, is known as- **A vectored interrupt**

■ The clock frequency of 8085 microprocessor is 5 MHz. If the time required to execute an instruction is 1.4 microsecond, then the number T-states needed for executing the instruction is- **7**

■ The first Microprocessor was – **Intel 4004**

■ The highest priority interrupt in 8085 microprocessor is- **TRAP**

■ Considering microprocessor, what is 'R' in RISC– **Reduced**

■ In ..... component of microprocessor 'accumulator' is placed – **Arithmetic and logic unit**

■ While using the command RRC, ... flags are modified– **CY**

■ Number of T-states in the STA command of 8085 microprocessor is ____ **13**

- Accmulator in 8085 microprocessor is an ____ bit register– **8**
- In 8085 microprocessor, _____ interrupt has the lowest priority– **INTR**
- An 8085 microprocessor has ..... address lines- **16**
- Data transfer operation of the 8085 microprocessors is - **MOV,STA & LDA**
- Performance of the logic instruction 'ORA R/M' by the 8085 microprocessors is – **Logically OR the contents of the register/ memory with the contents of the accumulator**
- Flag bits in arithmetic unit provide- **Status type information**
- In 8085 microprocessor, when the PUSH instruction is executed the stack pointer register is _____ and when the POP instruction is executed the stack pointer is _____ respectively- **Decremented by two, incremented by two**
- In an 8085 microprocessor, instructions means 'Jump to 16-bit address if the sign flag is set'– **JMP 16 bit**
- .....general purpose registers are there in 8085 microprocessor to store 8-bit data– **6**
- In 8085 microprocessors, MVI A, 23H is an example of – **Immediate addressing**
- ALU, control unit and _____ are the three main units of an 8085 microprocessor– **registers**
- Both ALU and control section of CPU employ which special purpose storage locations– **Accumulators**
- A microprocessor is Arithmetic logic unit and also– **Register unit and control unit on a single chip**
- Highest priority interrupt is– **RST 4.5**
- The number of output pins of an 8085 microprocessors are– **27**
- The program counter in an 8085 microprocessor is a 16 bit register because– **There are 16 address lines**
- In a microprocessor, the address of the next instruction to be executed, is stored in– **Program counter**
- NOP instruction is used to– **Replace the existing instruction, Debug the program, Insert the delay**
- Assembly language instructions of μP 8085 Which affect the contents of the accumulator is – **CMA, DAA, ADDB**
- The number of machine cycles in the instruction LDA 2000 H that consist of thirteen states is – **4**
- For ..... instructions, 9-bits are involved in the rotation- **RRC A**
- 8085 microprocessor has.....individual flags during arithmetic and logic operations- 5
- In 8085 microprocessor, instruction XCHG is- **1 byte instruction**
- Language is understood by 'Micro Processor' is - **Binary**
- In 8085 microprocessor____ bit register which holds the address of next instruction to be fetched is_____- **16 bit, Program counter**
- If RST7.5 interrupt is invoked in 8085, it will execute the ISR from _____ address- **003CH**

- In an instruction of 8085 microprocessor, ... bytes are present- **One, Two or three**
- A bidirectional bus is– **Data bus**
- The total number of pins in 8085 are– **40**
- In 8085 microprocessor, after the execution of XRA A instruction - **The zero flag is set**
- The software used to drive microprocessor based system is called– **Assembly language**
- A register in the microprocessor that keeps track of the answer or result of any arithmetic or logic operation is the – **Accumulator**
- Ready pin of a Microprocessor is used – **To introduce wait states**
- Most of the memory system have- **Magnetic properties**
- In 8085, instruction ADD IMMEDIATE to ACCUMULATOR WITH CARRY is represented by the opcode - **ACI**
- In 8085, instruction ADD IMMEDIATE to ACCUMULATOR WITHOUT CARRY is represented by the opcode **ADI**
- In an 8085 microprocessor, the instruction CMP B has been executed while the content of the accumulator is less than that of register B. As a result- **Carry flag will be set but Zero flag will be reset**
- In 8085 microprocessor, stack works on– **LIFO Principle**
- .....instructions of 8085 microprocessor adds contents of register pair BC and HL, the result of which is stored in HL- **DAD B**
- Machine cycles used for the execution of instruction MVI B, 4CH in 8085 microprocessor is- **Opcode Fetch, Memory Read, Memory Write**
- An 8085 microprocessor has ..... address lines- **16**
- ROM stands for- Read Only Memory
- 8085 MPU is - 8 bit
- The total addressable memory size of 8085 is- **64 kb**
- The number of hardware interrupts (which require an external signal to interrupts) present in an 8085 microprocessor is– **5**
- The control signal ALE is sent by Intel-8085 in order to- **Achieve separation of address from data.**
- .....section of the CPU affects and sequences all events within the CPU and the entire microcomputer- **Control and timing section**
- The 8085 MPU can address- **2^{16} memory locations**
- Scratch pad memory is - **local temporary memory**
- The minimum number of MOS transistor required to make a dynamic RAM cell is - **1**
- The number of active status flag present in 8085 microprocessor are - **5**
- Computational circuit in CPU is referred to as the .....- **ALU**
- Operations performed by the CPU of a computer system is - **Arithmetic operation, Control instruction processing**
- The synchronization between microprocessor and memory is done by- **READY signal**

- A microprocessor is called an 'n-bit microprocessor' depending on- **Size of the internal data bus**
- Intel 8085 is an____MPU- **8 bit NMOS**
- The 8085 is an enhancement of the popular INTEL_____microprocessor- **8080**
- Which is Primary memory- **On Board Memory**
- Unit of memory is- **Byte, MB, GB, TB**
- Type of RAM which is easier to interface with a microprocessor is - **Static**
- Program is a - Set of instructions
- The number of first practical microprocessor was– **Intel 4004**
- A microprocessor with a 12 bit address bus will be able to access——— **4 Kbytes memory**
- Normally a microprocessor cycles between—— **Fetch and execute state**
- In an 8085 μP system, the RST instruction will cause an interrupt– **Only if interrupts have been enabled by an EI instruction**
- vectored interrupt is- TRAP, RST 7.5, RST 6.5, RST 5.5
- The 8085 MPU requires a power supply of- **+5V single**
- Address line for TRAP is – **0024H**
- The permanent memory is- **ROM**
- The full form of ALU is - **Arithmetic logic unit**
- The basic elements of a microprocessor are..... **ALU, control unit**
- The size of stack pointer in an 8085 micro processor is- **16 bit**
- A microprocessor is capable of addressing 64 K bytes of memory. Its address bus width is- **16**
- A 64 K ROM chip will have - **16 Address Lines and 8 data line**
- After completing the execution, the microprocessor returns to- **Fetch state**
- In a microprocessor– **One machine cycle consists of several clock cycles**
- To multiply a number by 8 in 8085 we have to use RAL instruction– **Thrice**
- In 8085 microprocessor, the value of the most significant bit of the result following the execution of any arithmetic or Boolean instruction is stored in the- **Sign status flag**
- The number of address lines required to address a memory of size 16K is - **14**
- Four memory chips of 256×4 sizes have their address buses connected together. The size of the system will be - **256×16**
- Program counter (PC) register is an integral part of - **CPU**
- The Complement Accumulator (CMA) instruction of 8085 processor in execution affects- **No Flag,**
- Flag which does not change by the execution of the instruction DCR B in 8085 microprocessor is - **Carry**
- Addressing mode used in the instruction RET is- **Implicit**
- When an instruction is read from the memory, then it is called- **Memory Read cycle**

- In 8085 micro processor, instruction which affect the flag are- **Logical instruction, Branching instruction, Arithmetic instruction**
- In a 8085 microprocessor system with memory mapped I/O – **Arithmetic and logic operations can be directly performed with I/O data**
- Clock speed of a 8085 microprocessor is - **3 MHz**
- The contents of stack pointer (SP) specify- **Address of the top of stack**
- The contents of instruction register specify- **Opcode for the instruction being executed**
- An instruction consisting of an operation code and operand address is called - **Machine language instruction**
- Number of machine cycles in the execution of instruction STA 2000 H instruction take in an 8085 processor is - **4**
- In the register indirect addressing mode of 8085 microprocessor, data is stored– **At the address contained in the register pair**
- The active high signals in 8085 microprocessor are- **ALE, HLDA, READY**
- Addressing mode used in the instruction LXI B 0034H is- **Immediate**
- In 8085 programming SIM is used for - **Serial outputting**
- Instruction LHLD 2000H is an example of - **Direct addressing**
- In 8085 to disable the whole interrupt system (except TRAP) - **The DI instruction may be used**
- The instruction that exchanges stack–top with HL pair is:– **X T H L**
- The serial data can be input through SID line by - **Executing a RIM instruction**
- An I/O processor control the flow of information between- **Main memory and I/O devices**
- Program which translates an assembly language programme into binary machine language is known as- **Assembler**
- Compared to a CISC Processor, a RISC processor has - **Less number of instructions**
- Bus in computer is- **Bunch of wires**
- Number of bits needed to code 64 operations is- **6**
- Assembly language is a– **Machine dependent language**
- Compact Disk (CD) is - **Secondary Memory**
- A micro-processor with a 16-bit address bus is used in a linear memory selection configuration (i.e. Address bus lines are directly used as chip selects of memory chips) with 4 memory chips. The maximum addressable memory space is– **64K**
- The number of Memories required of size 16 ×4 to design a Memory of size 64×8 is– **8**
- The direction of control bus is- **Mixed direction i.e., some lines into µP and some others out of µP**
- ..... is used for serial access storage only– **Magnetic tape**

- For each instruction of program in memory, the CPU goes through a - **Fetch-decode-execute sequence**
- ..... methods bypasses the CPU for data transfer- **Direct Memory Access (DMA)**
- The ASCII Code is for information interchange by binary code for - **Alphanumeric and other common symbols**
- ..... bits internet address is assigned to each host on a IPv4 internet which is used in all communications with the host- **32 bits**
- SDRAM refers to - **Synchronous DRAM**
- Address line for RST6 is - **0030H**
- The no. of address lines required to address a memory of size 32 K is- **15**
- To multiply a number by 16 in 8085 microprocessor, we have to use RAL instruction with CY set to 0 - **four times**
- A 2048 × 8 EPROM has- **11 Address pin and 8 Data pin**
- Dynamic memory is made up of- **MOS transistor gate**
- Each cell of a static Random Access Memory contains– **6 MOS transistors**
- The use of a cache in computer system increases the– **Available speed of memory access**
- Fastest memory cell is - **Semiconductor memory**
- In..... ultraviolet light used to erase the stored contents - **EPROM**
- The basic memory cell in a DRAM is a- **Capacitor and a MOS switch**
- The Total Number of Ground (GND) pins in 8086 microprocessor is equal to – **2**
- Pipelining technique is used in microprocessor to improve - **Maximum clock frequency**
- An index register in a digital computer is used for - **Address modification**
- The Processor 80386/80486 and the Pentium processor uses _____Bits address bus- **32**
- Memory addressing capacity of 8086– **1 MB**
- There are ..... bits in physical address of instruction in 8086– **20**
- In 8086 MPU allows clock frequency upto– **10 MHZ**
- A microprocessor is a ____ chip integrating all the functions of a CPU of a computer– **Signal**
- Microprocessor is a/an ____ circuit that function as the CPU of the computer– **electronic**
- Microprocessor is the ____ of the computer and it perform all the computational tasks– **Heart**
- The first digital electronic computer was built in the year_____– **1940**
- In 1960's texas institute invented_____– **Integrated circuits**
- The Intel 8086 microprocessor is a ____ processor **–16 bit**
- The size of a flag register of an 8086 microprocessor- **16 bit**
- The microprocessor can read/write 16 bit data from or to _____ **Memory**

- The work of EU is _____ **Decoding and exicute**
- There are ..... types of flags in 8086- **9**
- The total size and the ---------- of Interrupts procedures that can be defined in this memory of 8086 is- **1K Bytes, 256 Procedures**
- The CF is known as _____ **Carry flag**
- The SF is called as _____ **Sign flag**
- The OF is called as _____ **Overflow flag**
- The IF is called as _____ **Interrupt flag**
- The register AX is formed by grouping ___– **AH & AL**
- The memory addressing capacity of 8086 is - **1 Megabyte**
- The SP is indicated by _____ **Stack pointer**
- The BP is indicated by ____ **Base pointer**
- The SS is called as ____ **Stack segment**
- The index register are used to hold _____– **Memory register**
- The BIU contains FIFO register of size _____ bytes **6**
- The BIU prefetches the instruction from memory and store them in ___ **Queue**
- The 1MB byte of memory can be divided into ____segment – **64 kbyte**
- The pin configuration of 8086 is available in the___ **40 pin**
- The DS is called as ____ **Data segment**
- The CS register stores instruction in ___ segment – **Codes**
- The IP is ____bits in length – **16bits**
- The push source copies a word from source to ____– **Stack**
- Multiplexing of address and data lines is used in - **Intel 8086**
- LD's copies to consecutive words from memory to register and LD's – **DS**
- INC destination increments the content odd destination by_____– **1**
- The 8086 MPU permits a clock frequency of upto-**5, 8, and 10 MHz**
- IMUL source is a signed _____ –**Multiplication**
- ____ destination inverts each bit of destination – **NOT**
- The JS is called as _____ **Jump the signed bit**
- The execution time of a computer program requiring negligible I/O operations depends primarily on the speed of - **CPU**
- Instruction providing both segment base and offset address are called ____ **Far type**
- The condensational branch instruction specify ____ for branching – **Conditions**
- NMI stands for- Non-maskable interrupt
- The ____ translates a byte from one code to another code– **XLAT**
- For the 8085 assembly language program given below, the content of the accumulator after the execution of the program is - **67H**
- The ___ contains an offset instead of actual address– **IP**
- The 8086 fetches instruction one after another form _____ of memory – **Code segment**

- The pin of minimum mode AD_0- ADF_{15} has ___ address – **16 bit**
- Microprocessor place 16 bit address on the address bus- **One**
- The function of Pins from 24 to 31 depend on the mode in which ____ is operating **–8086**
- In 8086, the result of MOV AL, 65 is to store- **01000001 in AL**
- If MN/MX is low the 8086 operators in ___ mode – **Maximum**
- ___ signal prevet the microprocessor from reading the same data more than one – **Handshaking**
- The 16 bit flag of 8086 microprocessor is responsible to indicate- **Condition of result of ALU operation**
- The ____ pin is use to select direct command word– **AO**
- 8086 and 8088 contains _____ transistors – **29000**
- In 8086 Example for Non maskable interrupts are – **TRAP**
- In ..... modes in 8255 A PPI can port A be used as a bidirectional data bus– **Mode 2**
- The 8251A programmable communication chip is designed for– **synchronous and asynchronous serial data communication**
- A plug and play storage device that simply plugs in the port of a computer is– **Flash Drive**
- In computer system RS–232 is a standard which applies for- **Serial port**
- An input device in computer system- **Keyboard, Mouse, Scanner**

PREVIOUS YEA

1. Single-bit indicators that may be set or clear to show the results of logical or arithmetic operations are the–

(a) Data pointer (b) Flags
(c) Accumulator (d) Stack pointer

RRB JE- 01.09.2019

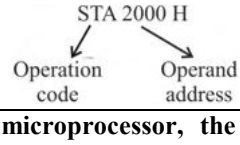
Ans. (b) : Single-bit indicators that may be set or clear to show the results of logical or arithmetic operations are the flags.

2. An instruction consisting of an operation code and operand address(es) is called :

(a) Mnemonics
(b) Pseudo code
(c) Assembly language instruction
(d) Machine language instruction

RRB SSE (shift-III), 02.09.2015

Ans : (d) An instruction code consists of operation code and operand address is called machine language instruction.



3. In 8085 microprocessor, the 16-bit registers

- ..... is a DMA controller- **Intel 8257/ 8237**
- DMA channel data facilitates data to move into and out of the system.....- **Without program intervention**
- ..... of 8255 PPI is only used in BSR mode - **Port C**
- The Length of IP Address in IPv 6 is- 128 Bits
- The number of the chip that is used as a keyboard or display controller in 8085 microprocessor is- 8279
- An I/O processor control the flow of information between- Main memory and I/O devices
- ..... are called peripheral of a computer- Input and output units
- In 8255, port C can work as 8 bit port in:– Mode 0 only
- A peripheral device is- Visual display unit, Modem, Pen Drive
- An example of embedded system is- **Mobile, Digital camera, Tablet**
- In microprocessor based system DMA refers to- **Direct memory access for the i/o devices**
- The concept of utilizing the bus for DMA operations is known as- **Cycle stealing**
- Telemetry allow data flow in _____. **Single direction**
- In industrial communication, DTE stands for: **Data Terminal Equipment**
- In OSl model accounting, addressing and routing functions of the system are provided by- **Network layer**
- A data Transreceiver to modulate & demodulate a signal is commonly referred to as– **Modem**

AR QUESTIONS

used are:

(a) Stack pointer and accumulator
(b) Program counter and accumulator
(c) Stack pointer and program counter
(d) Accumulator, stack pointer and program counter

RRB SSE Shift-II, 03.09.2015
LMRC SCTO (Electronics) 16.04.2018, Shift-II

Ans. (c) : Stack pointer : it is a 16- bit register which is use to point top of stack memory.
Program counter : The program counter hold the address of next instruction to be executed. It is 16-bit register.

4. Out of the following 8085 signals
i. ALE
ii. INTA
iii. HLDA
iv. READY
The active high signals are:

(a) i, ii, iii (b) i, iii, iv
(c) ii, iii, iv (d) i, ii, iv

DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
RRB Kolkata 06.02.2005

Ans. (b) : ALE, HLDA and READY are active high signals in 8085 microprocessor.

ALE- This pin is used to separate the data bus from multiplexed (AD0-AD7).

- If the ALE pin is high, it selects the address bus from A0 to A7.
- If the ALE pin is low, it selects the D_0-D_7 data.

HLDA- It gives the information of receipt of HOLD signal (Acknowledge), after that it comes from high logic to low logic.

READY- If the READY pin is at logic high, it means that the peripheral device can transfer data, if READY pin is at logic low, the microprocessor ready to wait until is high.

5. Microprocessor 8085 can address location up to

(a) 32K (b) 128K
(c) 64K (d) 1M

LMRC JE (S&T) 12.05.2018
RRB Allahabad JE-25.10.2009
LMRC SCTO (Electronics) 16.04.2018, Shift-II
NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
LMRC SCTO Shift-I–2016
LMRC JE Electronics 2016

Ans : (c) 8085 microprocessor has 64K address location, 16 bit address bus and 8 bit data bus.

Number of places in the address = $2^{16} = 2^6\, 2^{10} = 64$ K (address location).

6. A program counter is a storage register for:

(a) Location of data in memory
(b) Location of instruction in memory
(c) Binary code for the operation to be performed
(d) Address of the next instruction to be executed

UPMRC (SCTO) 14.04.2021
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
RRB SSE (Shift-I), 03.09.2015
RRB SSE (Shift-II), 03.09.2015

Ans. (d) : Program Counter - This register is used to sequence the execution of the instructions. The function of the program counter is to point to the memory address from which the next byte it to be fetched. When a byte (machine code) is being fetched. The program counter is incremented by one to point to the next memory location.

7. What do the contents of stack pointer (SP) specify?

(a) Address of the bottom of stack
(b) Address of the top of stack
(c) contents of the bottom of stack
(d) contents of the top of stack

LMRC SCTO Shift-I–2016
RRB Bhubaneswar JE-II, 19.12.2010

Ans : (b) Stack Pointer - Stack pointer is a special purpose 16-bit register in the microprocessor which holds the address of the top of the stack. The stack pointer register in a computer is made available for general purpose use by program executing at lower privilege levels than interrupt handlers.

8. In a microprocessor when a CPU is interrupted, it

(a) Stop execution of instructions
(b) Acknowledges interrupt and branches of subroutine

(c) Acknowledges interrupt and continues
(d) Acknowledges interrupt and waits for the next instruction from the interrupting device.

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (d) In a microprocessor when a CPU is interrupted, it acknowledges interrupt and waits for the next instruction from the interrupting device.

9. The number of status flags in 8085 microprocessor is:

(a) 6 (b) 4
(c) 3 (d) 5

RRB Allahabad JE-19.12.2010

Ans. (d) : The flags generally reflect the status of arithmetic or logical operation.

S	Z		AC		P		CY
D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0

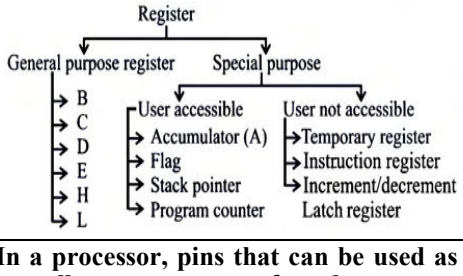
Carry flag (CY)
Parity flag (P)
Auxiliary Carry flag (AC)
Zero Flag (Z)
Sign flag (S)

10. Which of the following is NOT a General purpose Register of the 8085 microprocessor?

(a) D (b) C
(c) A (d) B

DMRC Electronics 19.04.2018, 12:15 to 2:30 PM

Ans. (c) : A is NOT a General purpose Register of the 8085 microprocessor.



11. In a processor, pins that can be used as inputs as well as outputs are referred to as ____.

(a) data pins (b) address path width
(c) address pins (d) data path width

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (d) : In a processor, pins that can be used as inputs as well as outputs are referred to as data path width.

12. A program counter is a storage register for:

(a) Location of data in memory
(b) Location of instruction in memory
(c) Binary code for the operation to be performed
(d) Address of the next instruction to be executed

UPMRC (SCTO) 14.04.2021
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
RRB SSE (Shift-I), 03.09.2015
RRB SSE (Shift-II), 03.09.2015

Ans. (d) : Program Counter - This register is used to sequence the execution of the instructions. The function of the program counter is to point to the memory address from which the next byte it to be fetched. When a byte (machine code) is being fetched. The program counter is incremented by one to point to the next memory location.

13. Which of the following statement is not true?

(a) Address bus is bidirectional
(b) Data bus is bidirectional
(c) Address bus is unidirectional
(d) Same data bus is used for both read and write operations

RRB JE Chennai -2014

Ans : (a) Address bus– It is a group of conducting wires, which carries address only. Address bus is unidirectional because data flow in one direction, from microprocessor to memory or from microprocessor to input/output devices. Length of Address Bus of 8085 microprocessor is 16-bit.

14. ALU in a microprocessor executes:

(a) a few arithmetic instructions only
(b) all arithmetic instructions only
(c) all arithmetic and logic instructions
(d) all arithmetic and few logic instructions

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (c) : The ALU is a combinational circuit and is that part of the processor that performs arithmetic, logic and other necessary related operations.

15. Accumulator is an integral component of

(a) CPU (b) Hard Disk
(c) RAM (d) Cache memory

(RRB SSE (Shift-III), 03.09.2015)

Ans : (a) Accumulator is an integral component of CPU. It works as a temporary storage location which stores mathematical and logical calculations.
Examples- In operation of 3+4+5 = 12, accumulator stores 3 first of all, then 7, then 12.
General purpose registers have replaced accumulators these days.

16. A microcomputer system consists of:

(a) Control and data bus only
(b) Data and address bus only
(c) Control and address bus only
(d) Control, data and address bus

LMRC JE (S&T) 12.05.2018

Ans.(d) : A microcomputer system consists of control, data and address bus. Microcomputer is such a computer in which microprocessor works as a central processing unit. It is smaller in size in comparison to main frame and mini computers.

17. 8085 Microprocessor does not have:–

(a) Zero flag (b) Parity flag
(c) Over flag (d) Auxiliary carry flag

DMRC JE-2013

Ans : (c) 8085 Microprocessor does not have Over flag.
There are five flags in 8085 microprocessor-
- Carry flag (CY)
- Auxiliary carry flag (AC)
- Sign flag (S)
- Parity flag (P)
- Zero flag (Z)

18. What is the direction of the data bus ?

(a) Uni-directional into μP
(b) Uni-directional out μP

(c) Bi -directional
(d) Mixed direction i.e. some lines into μP and some others out of μP

LMRC SCTO Shift-I–2016
RRB Mumbai JE-19.12.2010

Ans : (c) Data Bus - It is a group of conducting wires which carries data only. Data bus is bi-directional because data flow in both directions, from microprocessor to memory or input/output devices and from memory or input/output devices to microprocessor. Length of data bus of 8085 microprocessor is 8-bit (That is two Hexadecimal digits) ranging from 00H to FFH (H denotes Hexadecimal).

19. The data bus width of microprocessor is _____.
(a) 4 (b) 8
(c) 32 (d) 16

RRB Kolkata JE-25.10.2009

Ans. (b) : The data bus width of microprocessor is 8-bit, 8085 is an 8-bit NMOS microprocessor. It is manufactured from a single VLSI chip 40 pin DIP package.

20. Ready pin of a Microprocessor is used: –
(a) To indicate that the μp is ready to receive I/P
(b) To indicate that the μp is ready to receive O/P
(c) To introduce wait states
(d) To provide direct memory access

DMRC JE-20.04.2018

Ans : (c) Ready pin is used to interface with the slow peripheral devices (memory or I/O devices) to the μP.
• When ready pin is high only then μP will transfer or receive data from slow speed I/O device.
• When ready pin is low then μP waits till it goes high.

21. When the signal on RESET IN goes low, which of the following happens in 8085?
(a) The program counter is set to zero
(b) The buses are tristated
(c) The MPU is reset
(d) All of these

Konkan Railway STA-2017

Ans : (d) In 8085, when the RESET IN signal goes to low the program counter is set to zero, the buses are tristated and the MPU is reset.

22. The address bus of 8085 MPU is a group of:
(a) 8 lines (b) 12 lines
(c) 16 lines (d) 32 lines

Konkan Railway TA-2017

Ans. (c) In 8085 microprocessor, address bus is of 16-bits (A_0-A_{15}) and can transfer maximum 16-bit address and hence can address 65536 different memory locations. This bus multiplexed with 8-bit data bus.

23. Which section of the CPU affects and sequences all events within the CPU and the entire microcomputer?
(a) Registers
(b) ALU
(c) Instruction decoding circuitry

(d) Control and timing section

RRB Kolkata JE-25.10.2009

Ans. (d) : Control and timing section of the CPU affects and sequences all events within the CPU and the entire microcomputer.

24. The 8085 MPU can address–

(a) 2^8 memory locations
(b) 2^{12} memory locations
(c) 2^{16} memory locations
(d) 2^{32} memory locations

RRB Kolkata JE-25.10.2009

Ans. (c) : The 8085 MPU with its 16 address lines is capable of addressing 2^{16} memory locations.

- The address bus is a group of 16 lines generally identified as A_0 to A_{15}.
- The address bus is unidirectional because Bit flow in one direction from MPU to peripheral devices.
- The address is used to carry 16-bit address. The number of address line of MPU determines its capacity to identify different memory locations or peripherals.

25. Which of the following functions is not performed by a microprocessor ?

(a) Controlling timing of information flow
(b) Performing the computing tasks specified in a program
(c) Communicating with all peripherals using system bus
(d) Storing results and data

RRB Mumbai C &G JE-25.10.2009

Ans : (d) Data and result are not stored by microprocessor. Microprocessor is a multipurpose and programmable device which reads binary input form its memory and then gives output after processing the data as per instructions.

26. The number of bytes in an instruction for 8085 can be :

(a) One or two (b) One, two or three
(c) Two only (d) One only

RRB Mumbai C & G JE -25.10.2009

Ans : (b) For 8085, the number of bytes in an instruction are 1-bytes, 2-bytes and 3-bytes. 1-bytes instruction consist of the op-code and the operand. A 2-byte instruction consists of an op-code and an 8-bit address. A 3-bytes instruction consists of an op-code and 16-bit address.

27. A microprocessor is called an 'n-bit microprocessor' depending on-

(a) Register length
(b) Size of the internal data bus
(c) Size of external data bus
(d) None of these

RRB Allahabad JE-25.10.2009

Ans : (b) A microprocessor is called an 'n-bit microprocessor' depending on size of the internal data bus.

Example − 8-bit Microprocessor
16-bit Microprocessor

28. The 8085 is an enhancement of the popular INTEL_____ microprocessor:

(a) 8080 (b) 8155
(c) 8355 (d) 8086

RRB Patna JE-25.10.2009

Ans. (a) The 8085 is an enhancement of the popular INTEL 8080 microprocessor.
8085 is an 8 bit of microprocessor. Which is based on N-MOS technology.
8085 microprocessor = All the instruction of 8080 + RIM + SIM

29. The address bus of 8085 MPU is-

(a) Multi directional (b) Bi-directional
(c) Unidirectional (d) None of these

RRB Patna JE-25.10.2009

Ans. (c) The address bus is unidirectional because the data is a flow only from µp to memory or I/O device.

30. ALU, control unit and _____ are the three main units of an 8085 microprocessor.

(a) registers (b) LED display
(c) RAM (d) ROM

UPMRC (SCTO) 14.04.2021
RRB Bhopal TM SSE-25.10.2009

Ans. (a) : The microprocessor is made up of 3 main units. They are -

(i) Arithmetic and logic unit (ALU) - To perform arithmetic and logical instructions based on computer instructions.
(ii) Control unit - To control the overall operations of the computer through signals.
(iii) Registers - They are used to hold the instruction of the processor.

31. The clock frequency of 8085 MPU is ———— MHz

(a) 6 (b) 4
(c) 3 (d) 2

UPPCL JE (Trainee) Electronics 2015
RRB Bhopal TM SSE-25.10.2009

Ans. (c) : The clock frequency of 8085 MPU 3 MHz. Hence a crystal of 6 MHz crystal gets connected between X1 and X2. Every operation in the entire 8085 system occurs with the given synchronization process with the clock.

32. Normally a microprocessor cycles between——

(a) fetch and halt state
(b) fetch and interrupt state
(c) fetch and execute state
(d) halt and execute state

RRB Kolkata SSE-09.09.2012

Ans. (c) : The microprocessor follows a sequence: Fetch, Decode and Execute. Initially, the instructions are stored in the memory in a sequential order. The microprocessor fetches these instructions from the memory, then decodes it and executes those instructions till STOP instruction is reached. Later, it sends the result in binary to the output port. Between these processes, the register stores the temporarily data and ALU performs the computing functions.

33. The program counter and stack Pointer of 8085 are of:

(a) 16 bit and 8 bits respectively
(b) 8 bits each
(c) 8 bits and 16 bits respectively
(d) 16 bits each

LMRC SCTO (Electronics) 16.04.2018, Shift-II
RRB Bhopal SSE-09.09.2012

Ans. (d) : The program counter and stack pointer of 8085 are of 16 bits each.

- Stack pointer (SP) is used to point the top of stack memory (or hold the address of top of stack memory).
- It is part of RAM which is use to store temporary data.
- Stack works on "LIFO" technology.
- Program counter (PC) hold the address of next instruction to be executed.

34. READY signal in 8085 is useful when the processor communicates with

(a) A slow peripheral device
(b) A fast peripheral device
(c) A DMA controller chip
(d) A PPI chip

RRB Bangalore SSE-01.02.2009

Ans. : (a)
READY signal in 8085 is useful when the processor communicates with a slow peripheral device. This signal indicates that the device is READY to send or receive data.

35. In a microprocessor:

(a) One machine cycle is equal to one clock cycle
(b) One clock cycle consists of several machine cycles
(c) One machine cycle consists of several clock cycles
(d) One machine cycle is always less than one clock cycle

DMRC Electronic, 2014

Ans. (c) : In a microprocessor one machine cycle consists of several clock cycles. Each machine cycle consists of 3 to 6 T- states.

36. In 8085 microprocessor, the accumulator is a :

(a) 4 bit register (b) 8 bit register
(c) 16 bit register (d) 32 bit register

RRB Chandigarh SSE-26.02.2012

Ans : (b) Accumulator - The accumulator is an 8-bit register that is a part of arithmetic logic unit (ALU). This register is used to store 8-bit data and to perform arithmetic and logical operations. The accumulator is also identified as register A.

37. In a stack, we can access the element–

(a) Which is entered at beginning
(b) All of the options
(c) Which is entered at last
(d) From any position

RRB JE- 01.09.2019

Ans. (c) : In a stack, we can access the element which is entered at last. A stack has a restriction that insertion and deletion of element can only be done from only one end of stack and we call that position as top. The element at top position is called top element.

38. The 8085 has two registers known as primary data pointers. These are registers:

(a) B and C (b) C and D
(c) H and L (d) D and E

RRB JE 31.08.2019

Ans. (c) : The 8085 has two registers known as primary data pointers. These are H and L registers.
The registers W and Z are generally used as a temporary registers for the exchange operation.

39. Maximum memory accessed by 8085 is-

(a) 64 MB (b) 64 KB
(c) 80 MB (d) 85 MB

RRB Kolkata JE-25.10.2009
RRB Kolkata Engg. 20.02.2000

Ans : (b) The main features of 8085 are -
- It is an 8-bit microprocessor.
- It is manufactured with NMOS technology.
- It has 16-bit address bus and hence can address upto 2^{16} = 65536 (64 kB) memory locations through A_0-A_{15}.

40. In a 8085 microprocessor system with memory mapped I/O

(a) I/O devices have 8 bit address
(b) I/O devices are accessed using IN and OUT instruction
(c) There can be maximum 256 input and 256 output devices
(d) Arithmetic and logic operations can be directly performed with I/O data

DMRC Electronic, 2014
RRB BHUBANESWAR SSE-19.08.2001

Ans. (d) : In a 8085 microprocessor system with memory mapped input/output arithmetic and logic operations can be directly performed with input/output data. 8085 microprocessor has a 16 bit address. The memory map (64 k) is shared between the input/output device and system memory.

41. If READY pin of 8085 is low it means :

(a) 8085 is ready but peripheral device is not ready
(b) Both 8085 and peripheral device are not ready
(c) 8085 is not ready but peripheral device is ready
(d) Both 8085 and peripheral device are ready

RRB Kolkata Engg. 20.02.2000

Ans : (a) When READY pin of 8085 is low it means 8085 is ready but peripheral devices are not ready. Where the READY pin is used to delay the completion of the bus transfer cycle.

42. The pins available for Direct Memory access in 8085 are:

(a) SID and SOD (b) INTR and INTA
(c) S_0 and S_1 (d) HOLD and HLDA

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (d) : HOLD and HLDA pins available for DMA in 8085. Direct Memory Access (DMA) is a process of communication or data transfer controlled by an external peripheral.DMA is used in situations where microprocessor controlled data transfer is took slow, such as data transfer between a floppy disk and the systems R/W memory.

43. Consider the following operations in an 8085 microprocessor,
MVI A, A9H
MVI B, 57H
ADDB
ORA A
The carry flag status after last instruction is:
(a) 10 (b) 1
(c) 0 (d) cannot be determined
RRB Kolkata JE-II, 11.06.2006

Ans : (c) MVI A, A9H = 10101001
MVI B, 57H = 01010111
ADD B = 00000000
ORA A → Accumulator of OR operation with accumulator 00000000
00000000
00000000
Hence, the status of carry flag will be 0.

44. In 8085 microprocessor, after the execution of XRA A instruction:–
(a) The carry flag is set
(b) The accumulator contain FFH
(c) The zero flag is set
(d) The accumulator contents are shifted left by one bit
RRB Mumbai SSE-19.12.2010
RRB Kolkata Technical-III, 20.08.2006

Ans : (c) In 8085 microprocessor the zero flag is set after the execution of XRA A instruction. If the result of the operation performed in the ALU is zero then the zero flag is set (1). If the result is not null, then the flag is reset (0).

45. The instruction that exchanges stack-top with HL pair is:–
(a) PUSH H (b) S P H L
(c) X T H L (d) P C H L
RRB Kolkata Technical-III, 20.08.2006

Ans : (c) In 8085 instruction set, XTHL is that stands for Exchange Stack-top with HL pair. This instruction exchange the contents of the top two locations of the stack with the contents of HL register pair.

46. Out of the following.
i. SPHL
ii. LHLD 2000H
iii. PUSH H
iv. RAR
The instructions in which flags are not affected, are
(a) i, ii, iii (b) i, ii, iv
(c) ii, iii, iv (d) i, iii, iv
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
RRB Kolkata Technical III, 20.08.2006

Ans. (a) : SPHL, LHLD 2000H, PUSH instruction do not affect the flag.
In RAR instruction only CY flag is affected rest the flag remains the same.

47. Which instruction is one byte instruction?
(a) SPHL (b) SHLD
(c) JMP (d) XRI
Delhi Metro Electronics JE 2017
RRB Chennai Technical Engg. 15.04.2007

Ans : (a) SPHL instruction is 1-byte instruction while SHLD has a maximum instruction of 3-bytes and 5 machine cycles JMP is a 3-byte instruction and XRI is 2- byte instruction.

48. Which statement is correct :

(a) HLDA signal generated by DMA controller for peripherals

(b) HLDA signal is generated by 8085 for DMA controller

(c) HLDA signal generated by DMA controller for 8085

(d) HOLD signal is generated by 8085 for DMA controller

RRB Chennai Technical Engg. 15.04.2007

Ans : (b) HLDA signal is generated by 8085 for DMA controller.

Where, DMA → Direct Memory Access

HLDA → Hold Acknowledge

Acknowledge, when the HOLD line is high, it instructs the processor that another master is calling for this line.

49. The content of the accumulator of 8085 microprocessor after execution of the following instructions will be:

MVI A, A7H

ORA A

RLC

(a) FFH (b) 4FH

(c) 3FH (d) CEH

RRB Kolkata Apprentice Engg. 14.10.2001

Ans : (b) Given,

MVI A, A7H || A←A7 (10100111)

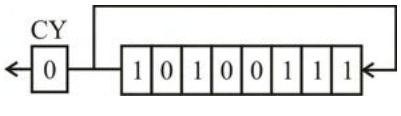
ORA A || A OR A

RLC

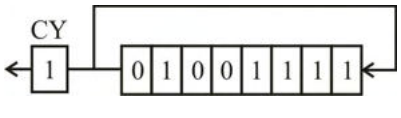
```
  1 0 1 0 0 1 1 1
  1 0 1 0 0 1 1 1
  ---------------
  1 0 1 0 0 1 1 1   CY = 0
```

RLC → Rotate Accumulator Left without Carry

Before execution of RLC



After execution of RLC



A = 4FH

50. Which instruction in an 8085 processor can set a flag?

(a) MOV B, C (b) JNZ 21 00H

(c) STA 20 00H (d) ADD B

RRB Bangalore 21.11.2004

Ans : (d) The flags of 8085 are set by ADD B instruction.

ADD B – Add Register (B) to Accumulator

51. How many machine cycles will the execution of instruction STA 20 00H instruction take in an 8085 processor

(a) 3 (b) 4
(c) 5 (d) 6

RRB Bangalore- 21.11.2004

Ans : (b) STA 20 00H−4 machine cycle

4 Machine Cycle = 1 Opcode fetch + 2 MEMR + 1 MEMW

This is a 3 byte instruction. Thus it will have 4 machine cycles.

52. Let the content of the memory location 3501 H be 72H. Now consider the following program with 8085 microprocessor

LDA 3501H
CMA
STA 3502H
HLT

The content of the memory location 3502H after execution of program will be:

(a) 27 H (b) D8 H
(c) 8D H (d) 72 H

RRB Patna/Allahabad ESM-II, 30.01.2011

Ans : (c) The address of the memory location 3501H and it stores 72H. Now CMA (Complement Accumulator)

$[A] \rightarrow 72H \rightarrow 01110010$

$[\bar{A}] \rightarrow 10001101$

$= 8DH$

53. In the register indirect addressing mode of 8085 microprocessor, data is stored–

(a) at the address contained in the register pair
(b) in the register pair
(c) in the accumulator
(d) in a fixed location of the memory

RRB Patna/Allahabad ESM-II, 30.01.2011

Ans : (a) Registers in 8085 microprocessor combine the indirect addressing mode into register pairs that group of address bus lines in the microprocessor. By which the microprocessor sends the addresses of the bits and input/output devices connected in it and identifies them for communication.

54. In 8085 microprocessor the contents of the accumulator, after the following instruction executed will become:–

X RA A
MVI B F0H
SUB B

(a) 01 H (b) 0F H
(c) F0 H (d) 10 H

RRB Kolkata 06.02.2005

Ans : (d) In 8085 microprocessor the contents of the accumulator will be after the execution of 10H instructions.

X RA A
MVI B F0H
SUB B

Stored in register A will be content = 00H
Stored in register B will be content = F0H

SUB B → 00H
−F0H

10H
---

55. In 8085, instruction ADD immediate to accumulator with carry is represented by the opcode-

(a) ADC (b) ACI
(c) ADD (d) ADI

RRB Kolkata JE-25.10.2009

Ans : (b) In 8085, the ADD instruction immediately to the accumulator with carry is represented by opcode ACI. Which means 8-bit data and carry flag is added to the accumulator opcode and result is stored in the accumulator.

56. In an 8085 microprocessor, the instruction CMP B has been executed while the content of the accumulator is less than that of register B. As a result

(a) Carry flag will be set but Zero flag will be reset
(b) Carry flag will be reset but Zero flag will be set
(c) Both Carry flag and Zero flag will be reset
(d) Both Carry flag and Zero flag will be set

Konkan Railway STA-2017

Ans. (a) : In CMP R instruction, accumulator register and R are compared i.e. (A–R) subtraction does the operation.

(i) if $A > R$
$CY = 0,\ Z = 0$
(ii) if $A < R$
$CY = 1,\ Z = 0$
(i) if $A = R$
$CY = 0,\ Z = 1$

57. The stack in microprocessor operates as-

(a) FIFO (b) LIFO
(c) FILO (d) None of these

Konkan Railway TA-2017

Ans. (b) : Stack operation is given the form of Last In First Out. It is also known as LIFO. On a stack, we can perform two operations PUSH and POP.

58. Which of the following are 3 byte instruction set?

(a) MV 1A, 32 H (b) JMP 2085 H
(c) MOV C, A (d) ADD B

RRB Chandigarh SSE-15.03.2009

Ans : (b) JMP 2085 H is 3-byte instruction set. MV is one byte and 32H is one-byte So in total it is two byte instruction.
MOV C, A is a one byte instruction
ADD B, is a one byte instruction
JMP is one byte and address 2085 H is two byte data. So there is a total of three byte instructions.

59. In 8085 microprocessor, PSW stands for _____.

(a) Program Stored Word
(b) Program Status Word
(c) Program Stack Word
(d) Program Set Word

RRB Bhubaneswar JE-II, 19.12.2010

Ans. (b) : In 8085 microprocessor, PSW stands for Program Status Word.

- Accumulator and flag register together called PSW.

←8-bit→	←8-bit→
A	Flag

60. When an instruction is read from the memory, it is called?

(a) Memory read cycle
(b) Fetch cycle
(c) Instruction cycle
(d) Memory write cycle

RRB Jammu SSE-2013

Ans : (b) When an instruction is read from the memory, it is called Fetch cycle.
Fetch cycle is the next instruction is fetched by the address stored in Program Counter (PC) and then stored in the instruction register.

61. After completing the execution, the microprocessor returns to

(a) Halt state (b) Fetch state
(c) Execute state (d) Interrupt state

RRB Bangalore SSE-01.02.2009

Ans. : (b)
Microprocessor after completing the execution process returns to fetch state. Fetch means the processor reads data from memory.

62. Register which is used to store values of arithmetic and logical operations is termed?

(a) Logical register (b) Controller
(c) Arithmetic register (d) Accumulator

RRB JE- 01.09.2019
DMRC JE-2013

Ans. (d) : The accumulator is an 8-bit register that is a part of arithmetic logic unit (ALU). This register is used to store 8-bit data to perform arithmetic and logical operations. The result of an operation is stored in the accumulator.

63. A High on RESET OUT indicates that:

(a) Processing can begin when this signal goes high
(b) All the register and counters are being reset and in addition this signal can be used to reset external support chip
(c) All the register of the CPU are being reset
(d) All the register and counters are being reset

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
RRB Jammu SSE-2013

Ans (b) : A high on RESET OUT signifies that all the registers and counters are being reset and in addition this signal can be used to reset external support chip.

64. A sequence of two instruction that multiples the contents of the DE register pair by 2 and stores the result in the HL register pair

(a) XCHG and DAD B
(b) XTHL and DAD H
(c) PCHL and DAD D
(d) XCHG and DAD H

RRB Allahabad SSE-19.12.2010

Ans. (d) : A sequence of two instructions that multiplies the contents of the DE register pair by 2 and stores the result in the HL register pair XCHG and DAD H.

65. 8085 is a /an ____ bit processor

(a) 8 (b) 16
(c) 24 (d) 64

LMRC SCTO (Electronics) 16.04.2018, Shift-II

Ans. (a) : The microprocessor is the CPU (Central Processing Unit) of a computer. It is the heart of the computer. Here we will describe Intel 8085 as it is one of the most popular 8-bit microprocessor.

66. A signed number will be viewed as a negative number if, in the Flag Register of 8085,____.

(a) $D_7 = 1$ (b) $D_7 = 0$
(c) $D_0 = 1$ (d) $D_0 = 0$

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (a) : In the 8085 μP flag register if the result obtained after any mathematical operation is the eight bit i.e. $D_7 = 1$ the sign flag is set (1). Reset when $D_7 = 0$

- $D_7 = 1$ the number is considered negative and when $D_7 = 0$ the number is considered positive.

67. The size of the directly addressable memory space with INTEL microprocessor is

(a) 64000 (b) 32000
(c) 44000 (d) 16000

DMRC (Regular)-2020

Ans. (a) : Main features of 8085 microprocessor-

- 8-bit microprocessor
- 16-bit address line
- 40-pin microprocessor
- 21 pin in
- 27 pin out
- 3 MHz clock speed
- 64k = 64000 Direct Addressable Memory

68. The Extended Industry Standard Architecture (EISA) also known as PC/AT expansion has bus size of

(a) 4 bit (b) 32 bit
(c) 8 bit (d) 64 bit

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (b) : The Extended Industry Standard Architecture (EISA) has bus size of 32 bit and also known as PC/AT expansion.

EISA is also improved Data Transfer Rate (DTR) up to 33 MB, automatic configuration, Synchronous Data Transfer Protocol (SDTP) and a compatible structure for older ISA buses with 8 or 16 bit data paths.

69. _____ address instruction is supplied to the microprocessor by an external device for INTR signal acknowledgement.

(a) HLDA (b) INTA
(c) HOLD (d) CALL

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (d) : The address instruction is given by the external device for INTR signal acknowledgment is CALL. The use of the instruction CALL in the main program is the subroutine instruction.1-byte is for opcode and 2-byte is for address subroutine.

70. What is the mnemonics for instruction XTHL?

(a) C5 (b) E3
(c) F9 (d) F5

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (b) : Mnemonics for the instruction XTHL is E3. XTHL in the 8085 instruction set is a mnemonics that stands for Exchange Top of Stack with HL. This instruction exchanges the contents of the top two locations of the stack with the contents of register pair HL.

Mnemonics Operand	Opcode (in Hex)	Bytes
XTHL	E3	1

71. ……is included in a microprocessor which stores the sequence of operations, referred to as the ……. in the form of binary codes.

(a) RAM; program
(b) ROM; program
(c) RAM; instruction
(d) ROM; instruction

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (b) : ROM is included in a microprocessor which stores the sequence of operations, referred to as the program in the form of binary codes

72. Which of the following will be done in an 8085 microprocessor when an instruction LXI H 2070H is executed?

(a) Content of the memory 2070H is loaded in H register
(b) 70 H is loaded in H register and 20 H is loaded in L register.
(c) 2070H is loaded in H register.
(d) 20 H is loaded in H register and 70 H is loaded in L register

UPMRC (SCTO) 14.04.2021

Ans. (d) : When the instruction LXI H 2070H is executed, 20H is loaded into the H register and 70H is loaded into the L register in the 8085 microprocessor. 20H and 70H are in hexadecimal.

73. The number of T-states used by the Intel 8085 instruction CMA is.

(a) 2 (b) 4
(c) 6 (d) 8

DMRC 23.02.2020, Shift-I

Ans. (b) : The number of T-states used by the Intel 8085 instruction CMA is 4.

Complement of the contents of the accumulator in CMA (Complement Accumulator) instruction is done.

Op Code	Operand	Bytes	M- Cycles	T-State
CMA	None	1	1 (F)	4T

74. Identify one byte instruction from the following:

(a) JMP 2085H (b) LDA 2050H
(c) MOV C, A (d) MVI A, 32H

Noida Metro Electronic JE 2017

Ans : (c) MOV C, A performs 1-byte instruction. This instruction MOV C, A copies the contents of the accumulator to register C. In this action any of the contents of the accumulator no change takes place.

75. Which instruction is one byte instruction?

(a) SPHL (b) SHLD
(c) JMP (d) XRI

Delhi Metro Electronics JE 2017

Ans : (a) SPHL instruction is 1-byte instruction while SHLD has a maximum instruction of 3-bytes and 5 machine cycles JMP is a 3-byte instruction and XRI is 2- byte instruction.

76. JMP addr 16 is a:
(Note: addr 16 is any 16 bit address)

(a) 2- byte instruction (b) 1- byte instruction
(c) 3- byte instruction (d) 4- byte instruction

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (c) : Jump instruction:- The program sequence is transferred to the memory address given in the operand.

Opcode	Operand	Bytes	M-cycles	T-states
JMP	16-bit	3	3	10

77. What is the number of T-states required to execute the following instruction?
LHLD addr16
(Note: addr16 is any 16-bit address)

(a) 10T (b) 6T
(c) 7T (d) 13T

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (*) : In 8085, LHLD stands for Load HL pair using direct addressing from memory location. This instruction uses absolute addressing mode for specifying the data in the instruction.

Opcode	Operand	Bytes	M-cycles	T-states
LHLD	16-bit address	3	5	16

78. Instruction HLT is for:

(a) Logic operations
(b) Arithmetic operations
(c) Machine control
(d) Data transfer

LMRC JE (S&T) 12.05.2018

Ans:(c) Instruction HLT is a Machine Control Instruction.
HLT:

- This instruction is used at the end of the program.
- When HLT instruction executed in 8085 microprocessor . The processor reaches HALT state and the buses go into tri-state.
- This is 1-byte instruction
- Machine cycle =2(Fetch)
- Total instruction execution time = 5T
- Addressing mode = Implicit

79. Instruction XRI FFH will:

(a) Reset the accumulator
(b) Complement the accumulator
(c) Clear the accumulator
(d) Set the accumulator

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (b) : XRI FFH is used complement the 8-bit (FFH) of the accumulator.

- XRI F0H is used to complement the upper four bits of the accumulator.
- XRI 0FH is used to complement the lower four bits of the accumulator.

80. The maximum number of bytes and machine cycle of 8085 instruction are:

(a) 3 bytes, 5 machine-cycles
(b) 3 bytes, 3 machine cycle
(c) 5 bytes, 3 machine cycles
(d) 5 bytes, 5 machine cycles

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
RRB Jammu SSE-2013

Ans. (a) The maximum number of bytes and machine cycles of 8085 instruction are 3 bytes and 5 machine cycles respectively. Instruction format used in Intel 8085.

1. One byte instruction
2. Two byte instruction
3. Three byte instruction

Machine cycles- Conceptual microprocessor generally requires the following 5 machine cycles.

1. Opcode fetch machine cycle
2. Memory read machine cycle
3. Memory write machine cycle
4. I/O read machine cycle
5. Write machine cycle

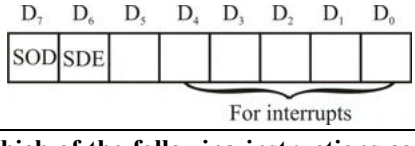
81. Which of the following is an output signal to Microprocessor 8085?

(a) SOD (b) HOLD
(c) SID (d) READY

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM
DMRC (Regular)-2020

Ans. (a) : In 8085 microprocessor, SOD (Serial Output Data) pin is used to output data serially from the microprocessor.

- The 8085 microprocessor has on 1-bit output port.
- Data is written to this port using the SIM instruction.
- The data to be written in the port is stored on 7th bit.
- The 6th bit of the accumulator is known as SDE (Serial Data Enable).
- To enable this bit must be set to 1.



82. Which of the following instructions can change the program sequence.

(a) SPHL (b) PCHL
(c) XTHL (d) XCHG

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM

Ans. (b) : PCHL instruction can change the program sequence.

PCHL: Load program counter with HL contents

Opcode	Operand	Byte	m-cycles	T-states
PCHL	None	1	1	6

The contents of register H and L are copied into the program counter. The contents of H are placed as the high order byte and content of L as the lower order byte.

83. Which register pair of 8085 is used to store the memory address for memory-related instructions.

(a) H, L registers (b) A, Flag register
(c) B, C registers (d) D, E registers

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (a) : HL register pair of 8085 is used to store memory address for memory related instruction. As-

- SHLD (Store HL Register Direct) This is a 3byte instruction.
- LHLD (Load HL register direct)

84. Which addressing system in LXI B 034H instruction is used to?

(a) Indirect (b) Direct
(c) Immediate (d) Register

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
RRB Allahabad JE -II, 08.01.2006

Ans (c) : In 8085microprocessor, instruction LXI B 034H means 034H is loaded in to the BC register pair.

- LXI is a type of immediate addressing mode.
- It can load 16-bit data into the register pair.
- It is a 3-byte instruction.

85. A single instruction to clear the lower four bits of the accumulator in 8085 assembly language is–

(a) XRI F0H (b) ANI 0FH
(c) XRI 0FH (d) ANI F0H

RRB JE- 01.09.2019

Ans. (d) : ANI F0H is used to clear the lower four bits of the accumulator.

- ANI 0FH is used to clear the upper four bits of the accumulator.
- XRI F0H is used to complement the upper four bits of the accumulator.
- XRI 0FH is used to complement the lower four bits of the accumulator.

86. Which is NOT a control instruction?

(a) RIM (b) HLT
(c) CMP (d) SIM

RRB JE- 01.09.2019

Ans. (c) : Control instructions are-
NOP - No operation is performed.
HLT - It stands for Halt. The CPU finishes executing the current instruction and stops further execution.
DI - Disable Interrupts
EI - Enable Interrupts
RIM- Read Interrupt Mask
SIM- Set Interrupt Mask
Note: CMP is not a control instruction. CMP is type of compare instruction-
CMP- It compares the data byte in the register or memory with the contents, of accumulator. It is 1-byte instruction.
CPI- It compare immediate with accumulator. It is a 2-byte instruction.

87. In an 8085 microprocessor, the instruction CMP B has been executed while the contents of accumulator is less than that of register B. As a result, carry flag and zero flag will be respectively–

(a) Set, set (b) Set, reset
(c) Reset, set (d) Reset, reset

RRB JE 31.08.2019

Ans. (b) : The instruction CMP B is executed by an 8085 microprocessor when the contents of the accumulator is less than the contents of register B. As a result, the carry flag will be set and the zero flag will be reset.

88. The register in the 8085A that is used to keep track of the memory address of the next op-code to be run in the program is the-

(a) Program counter (b) Accumulator
(c) Stack pointer (d) Instruction pointer

RRB JE 31.08.2019

Ans. (a) : The register in 8085A, which is used to track the memory address of the next op-code to be executed in the program, is called Program Counter (PC).
PC is a 16-bit register. This register is used to sequence the execution of the instructions. It is automatically incremented by 1.

89. To multiply a number by 8 in 8085 Microprocessor we have to use RAL instruction:

(a) Once (b) Twice
(c) Thrice (d) Four times

DMRC Electronic, 2017

Ans. (c) :
1st time $\rightarrow$ RAL $\Rightarrow$ Previous Value $\times$ 2
2nd time $\rightarrow$ RAL $\Rightarrow$ [Previous value $\times$ 2] $\times$ 2
3rd time $\rightarrow$ RAL $\Rightarrow$ [(Previous value $\times$ 2) $\times$ 2]$\times$ 2
= 8
or
$N = 2^n$
$8 = 2^n$
$2^3 = 2^n$
$n = 3$

90. The input signal to the Intel 8085 microprocessor that serves to delay the microprocessor read/write signals until a slow responding peripheral is able to send or accept data is

(a) READY (b) INTR
(c) RESET OUT (d) TRAP

DMRC (Regular)-2020

Ans. (a) : READY: When READY pin of 8085 is low, 8085 microprocessor becomes ready but peripheral devices are not ready where the READY pin is used to delay the completion of the bus transfer cycle and allow slow peripheral devices to become fast used to synchronize with the microprocessor. If the peripheral device is slow, so the microprocessor has to remain in waiting state.

91. The number of t-states required to executes the instruction MOV A, A is.

(a) 2 (b) 3
(c) 4 (d) 1

DMRC (Regular)-2020

Ans. (c) : MOV A, A have-
Length = 1-Byte
Machine Cycle =1 (Fetch)
T-States = 4

92. The size of the HL register pair in an Intel 8085 microprocessor is.

(a) 32 bits (b) 4 bits
(c) 16 bits (d) 8 bits

DMRC 23.02.2020, Shift-I

Ans. (c) : In the 8085 microprocessor, the size of HL register pair is 16-bit. It can be implemented in two way by a single 16-bit number or by two 8-bit numbers. These registers are used to store or copy temporary data by using instructions during the execution of the program.

93. In a microprocessor, the address of next instruction to be executed is stored in

(a) Stack pointer
(b) Address latch
(c) Program counter
(d) Any general purpose resistor

Delhi Metro Electronics JE-2017

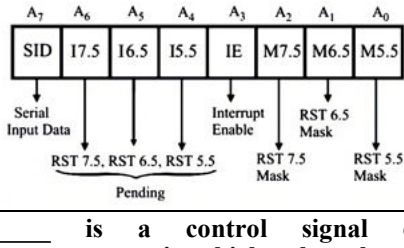
Ans. (c) : In a microprocessor, the address of next instruction to be executed is stored in program counter. Program counter is a 16-bit special-purpose register that is used to sequence the execution of the instructions.

94. The serial data can be input through SID line by:

(a) executing a RIM instruction
(b) using TRAP
(c) executing RST1
(d) executing a SIM instruction

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
Delhi Metro Electronic JE 2017

Ans. (a) : The serial data can be input through SID line by executing a RIM instruction. In 8085 instruction set, RIM stands for "Read Interrupt Mask". It is a 1-byte multi-purpose instruction.



95. _____ is a control signal of 8085 microprocessor, in which, when the pulse goes high, it indicates address. When the pulse goes down it indicates data.

(a) WR (b) ALE
(c) Clock (d) RD

Konkan Railway SSE-2015

Ans. (b) : ALE (Address Latch Enable) is a Control Signal of 8085 microprocessor, in which, when the pulse goes high, it indicates address. When the pulse goes down it indicates data,
If ALE = 1 then address bus (AD_0 - AD_7) enable.
If ALE = 0 then Data bus (AD_8 – AD_{15}) enable.

96. The synchronization between microprocessor and memory is done by-

(a) READY signal (b) ALE signal
(c) HOLD signal (d) None of these

RRB Malda SSE-25.10.2009

Ans : (a) Synchronization between microprocessor and memory is done by READY signal.
ALE - Signal means Address Latch Enables
When, ALE = 1 Address bus enable
ALE= 0 Data bus enable.
HOLD/HLDA - Signal is used for Direct Memory Access (DMA).

97. Which of the following does not constitute the minimum architectural unit of a microprocessor?
(a) ALU
(b) Program Counter
(c) Programmable Timers
(d) BUS Buffer and Latches

RRB Allahabad SSE-09.09.2012

Ans. (c) : Programmable timer is not the minimum structural unit of a microprocessor whereas ALU, program counter, bus buffers and latches are the structural unit of a microprocessor.

98. In 8085 MPU, sequencing the execution of instructions is done by the
(a) accumulator (b) flag
(c) stack pointer (d) program counter

RRB Allahabad SSE-09.09.2012

Ans. (d) : Sequencing the execution of instruction in 8085 microprocessor is done by program counter. The program counter serves as a pointer to the next instruction to be executed, and the memory location of the next instruction is always a 16-bit address. It is a 16-bit register because 8085 has 16-address lines.

99. The 8085 MPU requires a power supply of-
(a) +5V single (b) +5V dual
(c) +12V single (d) +12V dual

RRB Gorakhpur SSE-09.09.2012

Ans : (a) The 8085 MPU requires a power supply of +5V single.

100. The execution time of a computer program requiring negligible I/O operations depends primarily on the speed of
(a) memory (b) CPU
(c) I/O device (d) All of these

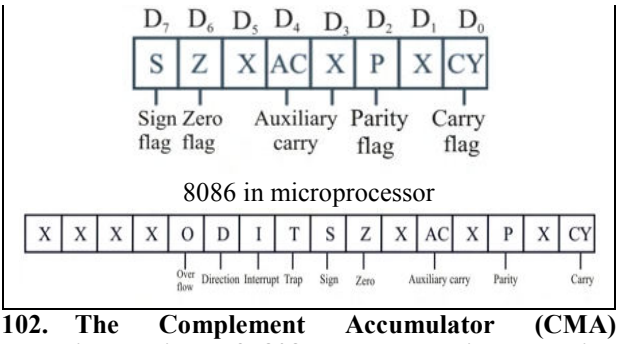
RRB Chandigarh SSE-09.09.2012

Ans : (b) The execution time of a program requiring negligible I/O operations depends primarily on the speed of the CPU.

101. In microprocessor architecture, flag indicates
(a) The name of manufacturer
(b) The internal status of the CPU
(c) The number of microprocessor
(d) The bit size of microprocessor

RRB Bangalore SSE-01.02.2009

Ans. (b) : Flag in microprocessor is used to know the status of the result obtained after the completion of any operation and it tells the internal status of CPU. This happens of different microprocessor. Like-8085 microprocessor has 8-bit register in which 5 are suitable and 3 are unsuitable and 16-bit in 8086 microprocessor. There are register in which 9 are appropriate and 7 are inappropriate in 8085 microprocessor.



102. The Complement Accumulator (CMA) instruction of 8085 processor in execution affects

(a) Zero Flag (b) Sign Flag
(c) Carry Flag (d) None of these

RRB Chandigarh SSE-26.02.2012

Ans : (d) CMA stands for Complement Accumulator. It performs complement operation on the current contents of accumulator and the result is stored back in the accumulator replacing its previous contents. Flag bits are not affected by this instruction. It occupies only1-byte in memory.

103. Which flag does not change by the execution of the instruction DCR B in 8085 microprocessor?

(a) Parity (b) Carry
(c) Zero (d) Sign

RRB Chandigarh SSE-26.02.2012

Ans : (b) The carry flag does not change by the execution of 8085 microprocessor instruction DCR B. When a carry is obtained in the result of a mathematical operation, this flag is set otherwise it is reset. It acts as a flag in subtraction operation.

104. Consider the following program segment with 8085 microprocessor
LXI H 3600H
MOV A, M
HLT
The MOV instruction involves:

(a) indirect addressing
(b) immediate addressing
(c) implicit addressing
(d) direct addressing

RRB Chandigarh SSE-26.02.2012

Ans : (d) MOV instruction in 8085 microprocessor is involved in direct addressing mode MOV instruction from a register in another register, from memory to register or register to memory are used for data transfer. When the instruction MOV A, M is executed, the data in the memory is copied to the register 'A' but the contents of the memory are not changed. They are available for re-copying as before.

105. The zero flag of 8085 microprocessor is to be set keeping the content of the accumulator unchanged. Which instruction is to be used?

(a) MOV A,A (b) ANI 00H
(c) XRA A (d) CMP A

RRB Chandigarh SSE-26.02.2012

Ans : (d) The CMP A instruction is used when the zero flag of the 8085 microprocessor is set to keep the contents of the accumulator unchanged.

CMP A [Compare (Register or Memory) with Accumulator] is 1- byte instruction.

Note–

(i) If (A) < (R/M) then CY flag is set and Zero flag is reset.

(ii) If (A) = (R/M) then Zero flag is set and CY is reset.

(iii) If (A) > (R/M) then both the Zero and CY flags are reset.

106. In a 8085 microprocessor system, the active low chip select $(\overline{CS})$ signal is generated by passing address lines A_{15}, ..., A_{10} through a 6 inputs NAND gate. For selecting the address range CC00 to CFFF, the inputs to the NAND gate are

(a) $A_{10}, A_{11}, \overline{A}_{12}, \overline{A}_{13}, A_{14}, A_{15}$

(b) $\overline{A}_{10}, \overline{A}_{11}, A_{12}, A_{13}, \overline{A}_{14}, \overline{A}_{15}$

(c) $A_{10}, A_{11}, \overline{A}_{12}, A_{13}, A_{14}, A_{15}$

(d) $A_{10}, A_{11}, A_{12}, A_{13}, A_{14}, A_{15}$

RRB Chandigarh SSE-26.02.2012

Ans : (a) Input of NAND gate for active low chip select in 8085 microprocessor system -

Address range CC00 – CFFF

1100 1100 0000 0000

1100 11 11 11 11 11 11

So, the inputs of NAND gate are A_{10}, A_{11}, $\overline{A}_{12}, \overline{A}_{13}, A_{14}, A_{15}$

107. In 8085 microprocessor, which type of instruction does not affect the flag?

(a) Data transfer instruction

(b) Logical instruction

(c) Branching instruction

(d) Arithmetic instruction

Delhi Metro Electronic JE 2017

RRB Jammu SSE-2013

Ans : (a) The data transfer instruction in 8085 microprocessor does not affect the flag. The data transfer instruction is used to transfer 8/16-bits of data into the source to destination register. The data transfer instruction performs "COP" operation.

108. Instruction LHLD 2000H is an example of :

(a) Implied addressing

(b) Indirect addressing

(c) Register addressing

(d) Direct addressing

RRB Allahabad JE-II, 08.01.2006

Ans : (d) LHLD 2000 H is a Direct addressing mode. Where LHLD 2000H means to send the element of memory location 2000H to H-L register pair. It is a 16-bit address and 3 byte instruction.

109. In micro processor like 8080 and the 8085, the ----------- cycle may have from one to five machine cycle–

(a) micro-instruction (b) source program

(c) instruction (d) fetch

LMRC SCTO Shift-I–2016

Ans : (c) In microprocessors like 8080 and 8085, an instruction cycle can have upto five machine cycles. 8080 and 8085 is an 8-bit microprocessor so it can have $2^8 = 256$ instruction. To understand the instructions of 8085 easily, they are classified into 5 group.

110. In a Microprocessor 8085, if the clock frequency is 5MHz, how much time is required to execute an instruction of 18T states?

(a) 6.4 microsecond (b) 4.2 microsecond
(c) 3.6 microsecond (d) 1.5 microsecond

Noida Metro Electronic JE 2017
RRB Bhubaneswar SSE-19.08.2001

Ans : (c) Given that,

$f = 5MHz$, T - State = 18T

$$\text{Execution time (t)} = \frac{1}{f} \times T = \frac{18}{5 \times 10^6}$$

$= 3.6\ \mu sec$

111. Which of the following interrupts has the lowest priority?

(a) RST 7.5 (b) TRAP
(c) RST 5.5 (d) RST 6.5

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (c) : RST 5.5 interrupts has the lowest priority in among all of the above.

Priority	Interrupt	Trigger	Vector Address
1	TRAP	Level & Edge	0024 H
2	RST 7.5	Edge	003C H
3	RST 6.5	Level	0034 H
4	RST 5.5	Level	002C H
5	INTR	Level	---------

112. Which of the following interrupts is NOT level triggered?

(a) RST 6.5 (b) INTR
(c) RST 5.5 (d) RST 7.5

DMRC Electronics 19.04.2018, 12:15 to 2:30 PM
DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (d) : RST 7.5 interrupt is not level triggered. RST 7.5 interrupt is edged triggered.

Inter-rupt	Prio-rity	Trigg-ered	Vect-ored	Address	Mask-able
TRAP	1st	Level/ edge	Yes	0024H	Non Maskable
RST 7.5	2nd	edge	Yes	003CH	Yes
RST 6.5	3rd	Level	Yes	0034H	Yes
RST 5.5	4th	Level	Yes	002CH	Yes
INTR	None	Level	Non vectored	None	Yes

113. The PCI support the interrupt line are

(a) Level Trigger
(b) Positive Edge Trigger
(c) Negative Edge Trigger
(d) Falling Edge trigger

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (a) : The PCI support the interrupt line are level trigger. PCI enables multiple devices to share a signal interrupt line using level triggered interrupts.

114. The non-maskable interrupt into to an Intel 8085 microprocessor is.

(a) RST 7.5 (b) NMI
(c) TRAP (d) INTR

DMRC (Regular)-2020

Ans. (c) : The non-maskable interrupt in an Intel 8085 microprocessor is TRAP. TRAP has highest priority among all other interrupts. Its vector address location is 0024H. TRAP is both edge and level trigger.

115. TRAP is.....where as RST 7.5, RST 6.5, RST 5.5 are.....:

(a) non-maskable:maskable
(b) non-maskable:non-maskable
(c) Maskable:maskable
(d) Maskable:non-maskable

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM
Noida Metro Electronic JE 2017

Ans : (a) TRAP is non-maskable where as RST 7.5, RST 6.5, RST 5.5 are maskable. A maskable interrupt has a comparatively higher response time. A non-maskable interrupt has a very low response time as compared to the maskable ones.

116. In 8085 TRAP is–

(a) always maskable
(b) cannot interrupt a service sub-routine
(c) used for catastrophic events like temporary power failure
(d) lowest priority interrupt

LMRC SCTO Shift-I–2016

Ans : (c) In 8085 TRAP is used for catastrophic events like temporary power failure. TRAP is non-maskable and vectored interrupts. It is a highest priority interrupt.

117. In 8085 to disable the whole interrupt system (except TRAP) :

(a) the DI instruction may be used
(b) the DO instruction may be used
(c) the interrupt instruction may be used
(d) the EI instruction may be used

LMRC SCTO Shift-I–2016

Ans : (a) The DI instruction may be used in 8085 to disable the whole interrupt system (except TRAP). TRAP is non-maskable interrupt.

118. What is the branching address of RST 6.5?

(a) 2CH (b) 24H
(c) 6CH (d) 34H

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (d) : To calculate vector address of RST n

$$n \times 8 = (X)_{10} \rightarrow (Y)_{16}$$

For RST 6.5

So, $(6.5 \times 8)_{10} = (52)_{10} \xrightarrow{\text{Hexadecimal}} 0034H$

Interrupt	Vector address
TRAP (RST 4.5)	0024H
RST (5.5)	002CH
RST (6.5)	0034 H
RST (7.5)	003CH

119. What are level triggering interrupts?

(a) INTR & TRAP (b) RST6.5 & RST5.5
(c) RST7.5 & RST6.5 (d) None of these

RRB Bhubaneswar JE-19.12.2010

Ans. (b) : RST 6.5 and RST 5.5 are level triggering interrupts.

Priority	Interrupt	Trigger	Vector Address
1st	TRAP	Level & Edge	0024 H
2nd	RST 7.5	Edge	003C H
3rd	RST 6.5	Level	0034 H
4th	RST 5.5	Level	002C H
5th	INTR	Level	---------

120. In a microprocessor when a CPU is interrupted, it

(a) Stop execution of instructions
(b) Acknowledges interrupt and branches of subroutine
(c) Acknowledges interrupt and continues
(d) Acknowledges interrupt and waits for the next instruction from the interrupting device.

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (d) In a microprocessor when a CPU is interrupted, it acknowledges interrupt and waits for the next instruction from the interrupting device.

121. Which among the following are level triggering interrupts?

(a) RST6.5 and RST5.5 (b) RST7.5 and RST6.5
(c) RST5.5 and RST7.5 (d) INTR and RST7.5

RRB Mumbai JE-05.10.2008

Ans. (a) : RST 6.5 and RST 5.5 both are level trigger-interrupt. It is hardware interrupt in 8085.

Priority	Interrupt	Trigger	Vector Address
1	TRAP	Level & Edge	0024 H
2	RST 7.5	Edge	003C H
3	RST 6.5	Level	0034 H
4	RST 5.5	Level	002C H
5	INTR	Level	---------

122. Which interrupt has the highest priority?

(a) INTR (b) TRAP
(c) RST 6.5 (d) None of these

RRB Mumbai JE-05.10.2008

Ans. (b) TRAP has the highest priority interrupts.
• TRAP is a non-maskable interrupt. Did not disable it. It is also known as RST 4.5 interrupt.

123. The number of hardware interrupts (which require an external signal to interrupt present in an 8085 microprocessor are————

(a) 1 (b) 4
(c) 5 (d) 13

RRB Kolkata JE-25.10.2009

Ans. (c) : **Hardware Interrupts:** Interrupts are the signals generated by the external devices to request the microprocessor to perform a task.
These are 5 interrupt signals, i.e.
INTR, RST7.5, RST6.5, RST5.5, TRAP.

124. The number of interrupt and flag registers in 8085 are respectively:

(a) 8, 5 (b) 5, 8
(c) 8, 8 (d) 5, 5

LMRC SCTO (Electronics) 16.04.2018, Shift-II
RRB Chandigarh SSE-25.10.2009

Ans. (d) : The number of interrupt is 5 and flag registers in 8085 is 5. The hardware interrupts are TRAP, RST 7.5, RST 6.5, RST 5.5 INTR and the flag registers are Sign(S), Zero (Z), Auxiliary Carry (AC), Parity (P) and Carry Flag (CY).

125. The order of priority for interrupts in 8085 MPU is

(a) RST 7.5, RST 6.5, RST 5.5, TRAP
(b) TRAP, RST 7.5, RST 6.5, RST 5.5
(c) RST 5.5, RST 6.5, RST 7.5, TRAP
(d) TRAP, RST 5.5, RST 6.5, RST 7.5

RRB Bangalore SEE-09.09.2012

Ans. (b) : The order of priority for interrupts in 8085 MPU is TRAP, RST 7.5, RST 6.5, RST 5.5 according to given interrupt.
TRAP interrupt has the highest priority and INTR has lowest priority.

126. NMI input is–

(a) Edge Triggered on Negative edge i.e. 1 to 0 transition
(b) Edge Triggered on Positive edge i.e. 0 to 1 transition
(c) Level triggered on 1
(d) Level triggered on 0

RRB Chandigarh SSE-26.02.2012

Ans. (b) : NMI input is edge triggered on positive edge i.e. 0 to 1.

- NMI stands for Non Maskable Interrupt.
- The 8086 has two hardware interrupt pins, i.e. NMI and INTR. NMI is a non-maskable interrupt and INTR is a maskable interrupt, one more interrupt pin associated is INTA called interrupt acknowledge.

127. When the 8085 receives an interrupt on its INTR pin

(a) The program is directly transferred to a fixed call location
(b) 8085 waits till an interrupt acknowledgement is received and transfers program to a fixed call location
(c) The call location is determined by an external device
(d) The program is transferred to a call location indicated by HL register pair

RRB Kolkata 06.02.2005

Ans : (b) When the 8085 receives an interrupt on its INTR pin 8085 waits till an interrupt acknowledgement is received and transfers program to a fixed call location. On receiving the INTR signal, the microprocessor issues another signal INTA. The INTR signal is enabled or disabled as required by the software used.

128. Which one of the following is not a vectored interrupt?

(a) TRAP (b) RST7.5
(c) RST3 (d) INTR

RRB Gorakhpur SSE-09.09.2012
RRB Kolkata Jr. Engineer-II 11.06.2006

Ans : (d) INTR is not a vectored interrupt. Non-vector does not have any fixed location. While vector interrupt is a processing technique in which the interrupting

device directs the process to the appropriate interrupt service routing.
Vector interrupt- RST4.5, RST7.5, RST6.5, RST5.5
Non-vector - INTR

129. Program which translates an assembly language programme into binary machine language is known as

(a) Assembler (b) translator
(c) interpreter (d) compiler

RRB JE 31.08.2019
LMRC JE (S&T) 12.05.2018

Ans : (a) Assembler : Assembler is a program which translates an assembly language program into binary machine language.
Translator : It translates program of one language into another language.
Compiler : It translates high programming language (e.g. C, C++, JAVA) into low level language or machine language.
Interpreter : It converts high language program into machine language (Low language). Interpreter is slightly different from compiler, Interpreter translates one statement in one time while compiler translates all the statements in one time.

130. Assembly language is a–

(a) Machine independent language
(b) Machine dependent language
(c) High-level language
(d) Language which requires interpreter

(RRB JE (Shift-2), 29.8.2015)

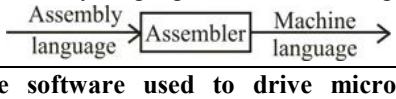
Ans : (b) Assembly language is a machine dependent language. It is a low level language. Assembler converts assembly language in machine language.

131. In a Computer, Assembler is

(a) a program that places programs into memory and prepares then for execution
(b) a program that automate the translation of assembly language into machine language
(c) a program that accepts a program written in a high level language and produces an object program
(d) is a program that appears to execute a source program it were machine language

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (b) Assembler- Assembler is a program that converts assembly language into machine language.



132. The software used to drive microprocessor based system is called:–

(a) Assembly language
(b) Firm ware
(c) High level language
(d) Basic interpreter instructions

DMRC JE-2013

Ans : (a) An assembly language is a low-level programming language for microprocessors and other programmable devices. It is not just a single language, but rather a group of language. An assembly language implements a symbolic representation of the machine code needed to program a given CPU architecture.

133. _____ works on translation of high level language programs to machine language for microprocessor execution.

(a) Assembler (b) Translator
(c) Compiler (d) Communicator

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (c) : Compiler is a computer program that translate a program written in a high level language into the machine language of the computer. The compiler is used to convert source code to machine code or to be translate into compiled code.

134. For the 8085 assembly language program given below, the content of the accumulator after the execution of the program is :

```
3000  MVI  A,  45H
3002  MOV  B,  A
3003  STC
3004  CMC
3005  RAR
3006  XRA  B
```

(a) 00H (b) 45H
(c) 67H (d) E7H

RRB Jammu SSE-2013

Ans : (c) When the program is executed the value in the register,
(1) CY =0; A = 45H
(2) CY =0; A = 45H; B = 45H
(3) CY = 1; A = 45H
(4) CY = 0; A = 45H; B = 45H
(5) CY = 1; A = 22H; B = 45H
(6) CY = 1; A = 67H
Hence, the value in accumulator will be A = 67H

135. For CALL or For JUMP is to branch if program area is outside ..... segment in 8086.

(a) 4K Byte (b) 16K Byte
(c) 32K Byte (d) 64K Byte

RRB Chandigarh SSE-25.10.2009

Ans : (d) For CALL or For JUMP is to branch if program area is outside 64K Byte segment in 8086.

136. The technique of assigning a memory address to each I/O device in the computer system is called-

(a) Ported I/O (b) Dedicated I/O
(c) Memory-mapped I/O (d) Wired I/O

RRB JE 31.08.2019

Ans. (c) : The technique of assigning a memory address to each I/O device in the computer system is called memory-mapped I/O. Memory-mapped input/output address the same address space to address both main memory and input/output devices. The memory and registers of the input/output devices are mapped to (associated with) address values. So a memory address may refer to either a portion of physical RAM, or instead to memory and registers of the input/output device.

137. First In First Out (FIFO) is used in-

(a) Stack (b) Linked list
(c) Queue (d) Tree

RRB JE 31.08.2019

Ans. (c) : A FIFO queue is a queue that operates on a First-In, First-Out (FIFO) principle. This means that the request (like a customer in a store or a print job sent to a printer) is processed in the order in which it arrives.

138. When a microprocessor has 1 MB addressing memory, its address bus width will be?

(a) 8 bits (b) 16 bits
(c) 20 bits (d) 32 bits

LMRC JE (S&T) 12.05.2018

Ans : (c) Give,

Addressing memory = 1 MB

we know that,

$$\boxed{\text{Addressing Memory} = 2^A \times D}$$

Where, A = Address bus
D = Data bus

$1\ MB = 2^A \times D$

$2^{20} \times 8 = 2^A \times D$

compared on both side

Address bus, $A = 20$

Data bus, $D = 8$

139. In microprocessor based system DMA refers to:

(a) Direct memory access for the microprocessor
(b) Direct memory access for the i/o devices
(c) Direct memory access for the user
(d) Direct memory access for the microprocessor and user

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM

Ans (b) : DMA stands for Direct Memory Access is a type of control unit that works as an interface for the data bus and the I/O devices. It contains an address unit, which generates the address and selects an I/O device for the transfer of data.

140. A microprocessor with a 12 bit address bus will be able to access————

(a) 0.4 kbytes memory (b) 8 kbytes memory
(c) 4 kbytes memory (d) 1 kbytes memory

RRB Bangalore SSE-09.09.2012

Ans. (c) : A microprocessor with 12-bit address bus is suitable for accessing 4 kbytes of memory.

A = 12 bit

We know that-

$$\text{Memory access capacity} = 2^A \times D$$
$$= 2^{12} \times 8$$
$$= 2^2 \times 2^{10} \times 8$$
$$= 4\text{Kbytes}$$

Where, $A \rightarrow$ Address line
$D \rightarrow$ Data line

141. A microprocessor uses 3 MHz oscillator. The duration of one T state is.

(a) 1μs (b) 0.666μs
(c) 0.333μs (d) 3 μs

RRB Kolkata Engg.20.02.2000

Ans. (c) : Given that,

- f= 3 MHz

$$\text{Time} = \frac{1}{f} = \frac{1}{3\text{MHz}} = \frac{1}{3} \times 10^{-6}\,\text{second}$$

$$T = 0.33\mu s$$

142. In 8086 microprocessor the following has the highest priority among all type interrupts.

(a) NMI (b) DIV 0
(c) TYPE 255 (d) OVER FLOW

RRB Allahabad JE-25.10.2009

Ans : (a) Priority of interrupt -

High Priority ↓
1. Hardware interrupt
2. Non-maskable interrupt
3. Software interrupt
4. Internal interrupt
5. Reset

So, In 8086 the NMI has the highest priority among all type interrupt.

143. The number of registers and flags in 8086 are;

(a) thirteen 16-bit registers and 9 flags
(b) fifteen 14-bit registers and 8 flags
(c) twelve 14-bit registers and 7 flags
(d) eleven 8-bit registers and 6 flags

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM
DMRC JE-20.04.2018

Ans. (a) : The number of registers and flags in 8086 microprocessor are thirteen 16-bit registers and 9 flags. Flags register is one of the special purpose register. The format of flag register is shown in below.

D_{15}	D_{14}	D_{13}	D_{12}	D_{11}	D_{10}	D_9	D_8	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
X	X	X	X	O	D	I	T	S	Z	X	AC	X	P	X	CY

Where,

CY	–	Carry flag.
P	–	Parity flag.
AC	–	Auxiliary carry flag.
Z	–	Zero flag.
S	–	Sign flag
T	–	Trap flag
I	–	Interrupt flag
D	–	Direction flag
O	–	Overflow flag

144. 8086 has a/an _____ bit address bus.

(a) 8 (b) 16
(c) 20 (d) 32

LMRC SCTO (Electronics) 16.04.2018, Shift-II

Ans. (c) : 8086 has a 20-bit address bus. 8086 microprocessor is a advance version of 8085 microprocessor.

- 8086 microprocessor has a 16 bit data line.
- Maximum memory handling capacity of 8086 is 1 MB.
- 8086 has 40 pin DIP.

145. In an 8086 microprocessor, in order to enable higher order byte of data, _____ signal is used.

(a) ALE (b) $\overline{DEN}$
(c) $\overline{BHE}$ (d) DT/R

UPMRC (SCTO) 14.04.2021

Ans. (c) : In an 8086 microprocessor, in order to enable higher order byte of data, $\overline{BHE}$ signal is used.

$\overline{BHE}$:- BHE stands for Bus High Enable. It is available at pin 34 and used to indicate the transfer of data using data bus D_8-D_{15}.

146. 8086 microprocessor is designed to have ____ data lines and _____ address line.

(a) 12; 16 (b) 16; 20
(c) 16; 16 (d) 20; 16

UPMRC (SCTO) 14.04.2021

Ans. (b) : 8086 microprocessor is designed to have 16-bit data lines and 20-bit address line. Address line is unidirectional and data line is bi-directional.

- It can access maximum 2^{20} (1 MB) memory location.
- The range of operating frequency 5Hz to 10 MHz.
- Power supply +5 volt signal.

147. Number of active flags in 16-bit register of 8086 is:

(a) 9 (b) 8
(c) 7 (d) 16

LMRC JE (S&T) 12.05.2018

Ans. (a): The flag registers is a 16-bit register in the 8086 microprocessor in which an active flags are as –

1. Sign flags (S)
2. Zero flags (Z)
3. Auxiliary Carry flags (AC)
4. Parity flags (P)
5. Carry flags (CY)
6. Over flags (O)
7. Direction flags (D)
8. Interrupt flags (I)
9. Trap flags (T)

D_{15}	D_{14}	D_{13}	D_{12}	D_{11}	D_{10}	D_9	D_8	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
X	X	X	X	O	D	I	T	S	Z	X	AC	X	P	X	CY

148. The number of memory segments in 8086 is:

(a) 2 (b) 4
(c) 8 (d) 16

LMRC JE (S&T) 12.05.2018

Ans. (b): There are 4 memory segments in 8086 microprocessor –

1. Code Segment Register (CS)
2. Data Segment Register (DS)
3. Stack Segment Register (SS)
4. Extra Segment Register (ES)

149. Which one of the following is NOT true for 8086?

(a) 16 bit processor (b) 16 bit data bus
(c) 16 bit address bus (d) 9 active flags

LMRC JE (S&T) 12.05.2018

Ans. (c): 8086 is -

- It has 16-bit data lines.
- It has 20-bit address line.
- Maximum memory handling capacity of 8086 is 1MB.
- It has 40 pin DIP.
- It can access maximum 2^{20} (1MB) memory location.
- The range of operating frequency 5 MHz to 10 MHz.
- H-MOS technology is used.

150. Types of addressing modes available in 8086 are:

(a) 2 (b) 4
(c) 8 (d) 16

LMRC JE (S&T) 12.05.2018
RRB Mumbai SSE-05.10.2008

Ans. (c): There are 8-types of addressing modes available in 8086 microprocessor.

Type of Addressing Mode in 8086 Microprocessor –

1. Register Addressing Mode.
2. Immediate Addressing Mode.
3. Register Indirect Addressing Mode.
4. Addressing Mode.
5. Resister Based Addressing Mode.
6. Indexed Relative Addressing Mode.
7. Based Indexed Addressing Mode.
8. Register Relative Addressing Mode.

151. The total size and the total number of Interrupts procedures that can be defined in this memory of 8086 is

(a) 256 Bytes, 256 Procedures
(b) 1K Bytes, 256 Procedures
(c) 256 Bytes, 1K Procedures
(d) 1K Bytes, 1K Procedures

Konkan Railway TA-2017

Ans. (b) : The total size and the total number of interrupts procedures that can be defined in this memory of 8086 is 1K bytes, 256 procedures. The first byte provides the op-code and the second byte provides the interrupt type number.

152. The memory addressing capacity of 8086 is :

(a) 32 KB (b) 64 KB
(c) 1 Megabyte (d) 32 Megabyte

RRB Mumbai C & G JE-25.10.2009

Ans : (c) The memory addressing capacity of 8086 is 1 Megabyte.

8086 microprocessor :-

- It has 16-bit data lines.
- It has 20-bit address line.
- It has 40 pin DIP.
- + 5 volt power supply.
- Percentage of duty cycle is 33.33%.
- 8086 uses pipelining.
- To speed the execution, 8086 μp includes two processing unit called
  1. Bus Interface Unit (BIU)
  2. Execution Unit

153. In 8086, the physical address of an instruction contains ..... bits :

(a) 10 (b) 16
(c) 18 (d) 20

RRB Mumbai C & G JE-25.10.2009

Ans : (d) In 8086, the physical address of an instruction contains 20 bits.

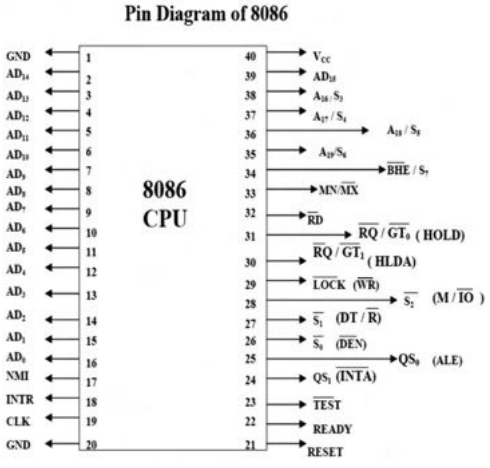
- In 8086 microprocessor, we use H-MOS technology and clock frequency is 5 MHz to 10 MHz.
- In 8086, 20 bit address line & 16-bit data lines.

154. The pin configuration of 8086 is available in the.....

(a) 40 pin (b) 50 pin (c) 30 pin (d) 20 pin

RRB Allahabad JE-25.10.2009

Ans : (a) The pin configuration of 8086 is available in the 40 pin.



- 8086 is a 16 bit microprocessor, it has 16 data lines and 20 address lines. There are two stages of pipeline in this.
  1. Fetch stage
  2. Executed stage

155. Intel 8086 is a

(a) 8 bit (b) 16 bit
(c) 32 bit μP (d) 64 bit

RRB Chandigarh SSE-09.09.2012

Ans. (b) : Intel 8086 is-

- It is a 16-bit microprocessor.
- It does not have a RAM or ROM inside it.
- The 8086 uses a 20 line address bus.
- It has 16 line data bus.
- It supports pipelining.
- Size of flag register is 16 bit.
- It has a segmented memory architecture.
- It works only with four 64 KB segments within the whole 1 MB memory.

156. 8086 has a/an _____ bit address bus.

(a) 8 (b) 16
(c) 20 (d) 32

LMRC SCTO (Electronics) 16.04.2018, Shift-II
RRB Chandigarh SSE-15.03.2009

Ans. (c) : 8086 has a 20-bit address bus. 8086 microprocessor is a advance version of 8085 microprocessor.

- 8086 microprocessor has a 16 bit data line.
- Maximum memory handling capacity of 8086 is 1 MB.
- 8086 has 40 pin DIP.

157. How many address lines are necessary to address two megabytes (2048 kb) of memory

(a) 20 (b) 21
(c) 19 (d) 11

RRB Chennai SSE-12.02.2012

Ans. : (b) Given that-

Memory capacity = 2MB

$$2^A \times D = 2 \times 2^{20} \times 8$$

$$2^A \times D = 2^{21} \times 8$$

$$\boxed{A = 21}$$

Where A→ Address line

158. A microprocessor with 12 address lines is capable of addressing-

(a) 1024 locations (b) 2048 locations
(c) 4096 locations (d) 64 K locations

RRB Bhopal SSE-09.09.2012

Ans. (c) : Given -
address line = 12
memory locations = 2^n
= 2^{12} = 4096
where n - number of address line

159. As compared 16 bit microprocessor, 8 bit microprocessors are limited in-

(a) Speed
(b) Directly addressable memory
(c) Data handling capability
(d) All the above

RRB Malda SSE-25.10.2009

Ans. (d) : 8-bit as compared to 16-bit microprocessor is limited in -
(1) Speed (2) Directly addressable memory (3) Data handling capacity (4) Processing power.

160. The 8255 Programmable Peripheral Interface (PPI), the number of I/O lines are

(a) 36 (b) 24
(c) 48 (d) 12

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (b) : The 8255 programmable peripheral interface has 24 I/O lines that are divided into three ports A,B and C.

161. The memory address of the last location of an 8K byte memory chip is FFFFH. What will be the starting address?

(a) E000H (b) FFDEH
(c) FFA4H (d) FF00H

NMRC Electronics 09.03.2017, 8:30 – 10:45 AM

Ans (a) : 8 K byte = 8×1024 byte
= $2^3 \times 2^{10}$ byte
= 2^{13} byte
Address line = 13
Maximum memory address for13 address line
= (0001 1111 1111 1111)
= 1FFFH
Starting address = FFFFH – 1FFFH = E000H

162. A microprocessor accessed by the outside world is being connected to external I/O devices by _____.

(a) I/O devices (b) I/O ports
(c) address bus width (d) data bus width

UPMRC JE (S&T)-03.01.2023, 1:30 PM - 3:30 PM
UPMRCL JE 03.01.2013, 1:30 PM - 3:30 PM

Ans. (c) :A microprocessor accessed by the outside world is being connected to external I/O device by address bus width.
Address Bus- It is a 16 bit bus used in 8085 microprocessor to select a particular memory location or a peripheral device it is a unidirectional bus.
Data Bus- Length or the data bus is 8 bits. This bus is used to transfer data between microprocessor and memory or input output devices in both directions.

Control Bus- Control bus is used to generator timing and control signals which control the operation of memory and various other peripheral devices.

163. The latest version of Peripheral Component Interconnect/Interface (PCI Bus) the expansion of ISA/EISA/PC - AT has the bus size of

(a) 64 bit (b) 16 bit
(c) 32 bit (d) 8 bit

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (c) : The latest version of PCI bus the expansion of ISA/EISA/PC-AT has the bus size of 32 bit. It has extended upto 64bit.

164. The original/early and most widely used PC expansion Bus scheme used is

(a) ISA (b) PCI
(c) EISA (d) MCA

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

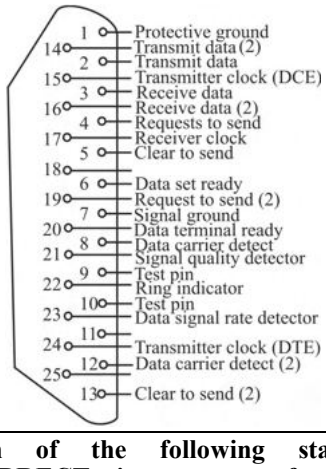
Ans. (a) : The original/early and most widely used PC expansion bus scheme used is ISA (Industry Standard Architecture).
ISA stands for Industry Standard Architecture and it is a type of bus used in PCs for adding expansion cards. For example, an ISA slot may be used to add a video card, a network card, an extra serial port. The original 8-bit version of PCI uses a 62 pin connection and supports clock speed of 8 and 33 MHz.

165. RS 232 Serial connector bus has.....

(a) 32 pins (b) 25 pins
(c) 29 pins (d) 36 pins

UPMRC JE (S&T) 03.01.2023, 1:30 PM-3:30 PM

Ans. (b) : RS 232 Serial connector bus has 25 pins.



166. Which of the following statements is INCORRECT in respect of a processor memory bus?

(a) Matched to the memory system to maximize the memory processor bandwidth
(b) Short and high speed
(c) Optimized for cache block transfers
(d) Is usually lengthy and slower

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (d) : Processor memory bus is a type of computer bus, usually in the form of a set of 8 wires or conductors, which serves to interconnect electrical components and from main memory to the CPU or memory controller allows the transfer of data and addresses.

- The memory processor co-ordinate with the memory system to maximize bandwidth.
- It is of small size and high speed.
- The processor memory bus is optimized for cache transfers.

167. Interaction between a CPU and a peripheral device that takes place during an input output operation prior to data transfer is known as:

(a) Handshaking (b) Flagging
(c) Relocating (d) Sub-routine

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (a) : Interaction between a CPU and a peripheral device that takes place during an input output operation prior to data transfer is known as handshaking.

168. How many address lines are required to interface 8 KB of memory?

(a) 13 (b) 10 (c) 12 (d) 11

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (a) : Given,
Memory size = $2^A \times D$
Memory size = 8 KB
= 8×1024 Byte
= $2^3 \times 2^{10}$ Byte = 2^{13} Byte
Address lines = 13

169. RS-232 interface standard has been defined by:

(a) EIA (b) ISO
(c) PCI (d) IEEE

DMRC Electronics 17.02.2017, 8:30 to 10:45 AM

Ans. (a) : RS - 232 was developed by Electronic industry association (EIA).
- RS-232 is used for serial communication.
- It is used for long distance communication.
- It is found in 25 pin dual package.
- RS-232 has maximum 25 signals.
- RS-232 is generally used for computer connecting (DTE) and modem connecting (DCE).

170. Which type of RAM is easier to interface with a microprocessor?

(a) static
(b) dynamic
(c) both static and dynamic
(d) none of these

RRB Allahabad SSE-09.09.2012

Ans. (b) : Dynamic RAM is easier to interface with a microprocessor. DRAM stores the binary information in the form of electric charges applied to capacitors. The stored information on the capacitors tends to loose over a period of time and thus capacitors must be periodically recharged to retain their usage. DRAM requires refresh time. The main memory is generally made up DRAM chips.

171. Five memory chips of 16 × 4 size have their address buses connected together. This system will be of size:

(a) 16×16 (b) 16×20
(c) 20×16 (d) 16×64

RRB Chennai SSE-12.02.2012
RRB Mumbai C & G SSE-25.10.2009

Ans. (b) Given-
1 memory chips of size = 16×4
There are a total size of 5 memory chips
Final memory is 16×4(5) = 16×20

172. RS-232 interface-
(a) Uses only positive voltage
(b) Cannot transmit signals over long distance
(c) Uses only negative voltage
(d) A logic high uses positive voltage

RRB Patna Technical Engg. 27.07.2008

Ans : (d) RS-232 interface is a logic high uses positive voltage. RS-232 is a standard communication protocol for connecting computers and their peripheral devices to enable series data exchange. RS-232 serial connector bus has 25 pins.

173. An I/O processor control the flow of information between:
(a) cache memory and I/O devices
(b) main memory and I/O devices
(c) two I/O devices
(d) cache and main memories

RRB Bangalore SSE-01.02.2009
RRB Patna JE-25.10.2009

Ans. : (b) The input/output processor controls the flow of information between the main memory and the input/output devices. The microprocessor generates control-signals that allow the microprocessor read and write operations are performed on it.

174. Which among the following write buffer is used by the pipeline ALUs order to write the result to the memory in a Pentium processor?
(a) External Snoop Write Buffer
(b) Line Replacement Write Buffer
(c) Write-back Buffer
(d) Internal Snoop Write Buffer

RRB Bangalore SSE-01.02.2009

Ans. (c) : In Pentium processor the write back buffer is used by the pipeline ALU to write the result to the memory.

175. _____ holds the binary pattern which is the code for the instruction currently being executed.
(a) Index register (b) Stack pointer
(c) Instruction register (d) Accumulator

DFCCIL (S &T) 17.12.2023, 12:30-2:30 PM

Ans. (c) : An instruction register, is a part of CPU that holds the binary pattern which is the code for the instruction currently being executed.

176. The machine cycles for the instruction SHLD address are:
F-opcode fetch
R-memory read
W-memory write)
(a) FRRR (b) FRRRR
(c) FRRW (d) FRRWW

DMRC Electronics 11.04.2018, 4:30 to 6.45 PM

Ans. (d) : SHLD 16 bit address : Store H and L register direct.

Opcode	Operand	Byte	M-cycle	T-state
SHLD	16-bit	3	5	16

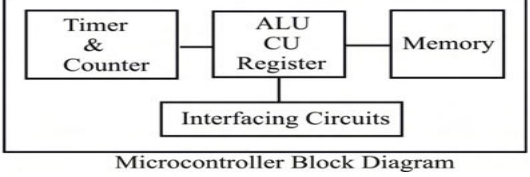
5M cycles of SHLD, first op-code fetch, second and third memory read, fourth and fifth are memory write.

14.

8051 Microcontroller :

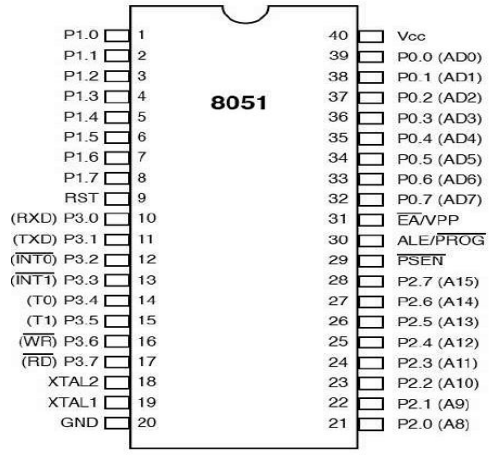
- **Difference between Microprocessor and Microcontroller :**

Microprocessor	Microcontroller
Microprocessors are designed to be used as the CPU of general purpose computers.	Microcontrollers are special purpose digital computers requires few external component for their working.
Microprocessor contains an ALU, general purpose registers, control and interrupt circuits, in one chip.	Microcontrollers have all these as well as timers, I/O ports, RAM and ROM on the chip.
Microprocessor requires many components such as, RAM, ROM etc for their working.	Many microcontroller requires no external component for their working as all these components are built onto the microcontroller chip.
Microprocessors have higher speed, greater data handling capacity and can address large amounts of memory. e.g. 8085, 8086 etc.	Microcontrollers have RAM, ROM built on same chip. Since the microcontroller are designed for use in machine such as a control device, they have slower speed and lesser address memory. e.g. 8051



Microcontroller Block Diagram

- **Pin Diagram –**



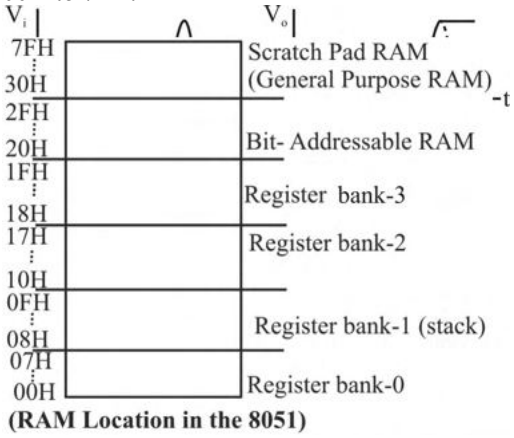
- It is 8 bit microcontroller.
- Microcontroller also known as single chip microcomputer.
- It has 128 byte of internal RAM and 4K byte of on-chip (ROM)
- 16 bit address bus and 8-bit data bus.

Microcontroller

- 32 general purpose register each of 8-bit
- 16-bit timer (usually 2, but may have more or less).
- 40 pins IC package
- Single power supply of +5V
- It is available in N-MOS and C-MOS technology
- 8051 microcontroller design by Intel (1981).
- External RAM 64-kbyte
- External ROM is 64-kbyte
- Maximum clock frequency 12 MHz.
- 8051 microcontroller has 8-bit PSW.
- In 8051 microcontroller, PC & DPTR (Data Pointer) are 16-bit register
- 8051 microcontroller has 8-bit SP(Stack Pointer)
- 8051 microcontroller has one-serial port.
- PSW (Program Status Word) consist of 4-math Flags (AC,CY,P,OV) and two register bank select bits.
- 8051 microcontroller has 21 SFR (Special Function Register).

■ **Internal RAM of 128-byte:**

- The address range of 128-byte internal RAM is 00H to 7FH.



(RAM Location in the 8051)

Pins 1-8	These pins are known as port 1. This port does not serves any other instructions. It is internally pulled up, bidirectional I/O port.
Pin 9	It is a RESET pin, which is used to reset the microcontroller to its initial values.
Pins 10-17	These pins are known as port 3. This port serves some function like interrupt timer input, control signal, serial communication signals RXD and TXD, etc.
Pins 18 -19	These pins are used for interfacing an external crystal to get the system clock.
Pin 20	This pin provides the ground to the circuit.

Pins 21-28	These pins are known as port 2. It serves as I/O port. Higher order address bus signal are also multiplexed
Pin 29	This is PSEN pin which stand for program store enable. It is used to read a signal from the external program memory.
Pin 30	This is a ALE Pin which stands for address latch enable. It is used to de-multiplex the address data signal of port.
Pin 31	This is a EA pin which stands for External Access input. It is used to enable /disable the external memory interface.
Pins 32-39	These pins are known as port 0, It serves as I/O Port, lower order address and data bus signals are multiplexed using this port.
Pin 40	This pins used to provide power supply to the circuit.

- **In 8051 there are six types of addressing mode.**

Addressing Mode	Examples
Immediate addressing mode	MOV A, # 0AFH. (Load 0AF into A)
Register addressing mode	MOV A, R5 (Copy the content of R5 into A)
Direct addressing mode	MOV R2, 45H (Copy the content of RAM location 45H in R2)
Register indirect addressing mode	MOV A, @ R0 (Move content of RAM location whose address is held by R0 into A
Indexed addressing mode	MOVC A, @ A + DPTR
Implied addressing mode	RLA

Interrupt Vector of 8051 :-

Interrupt	ROM location (in HEX)	Pin
Reset	0000	9
Internal Hardware interrupt (INTO)	0003	12
Timers 0 interrupt (TS0)	000B	13
External Hardware interrupt (ENT1)	0013	
Timer 1 interrupt (TF1)	001B	
Serial Communication	0023	

- **Features of 8051, 8052 and 8031**

Feature	8051	8052	8031
ROM (Bytes)	4 K	8 K	0 K
RAM (Bytes)	128	256	128
Timers	2	3	2
I/P Pins	32	32	32
Serial Port	1	1	1
Interrupt sources	6	8	6

- **Some important microcontroller ICs –**

Intel 8155	The 8155 includes 256 bytes of RD/WR memory i.e. RAM, 3 I/O ports and a 16-bit timer.
Intel 8257	(Programmable DMA Controller) Intel 8257 DMA Controller chip is a 40-pin programmable integrated Circuit. The DMA controller chip 8257 works in two modes, slave mode and master mode.
Intel 8259	(Programmable Interrupt controller) It is designed for the 8085 and Intel 8086 microprocessor. The 8259 combines multiple interrupt input source into a signal interrupt output to the host microprocessor.
Intel 8272	(Floppy Disk Controller) The function of floppy disk controller is to interface a floppy disk system to a microprocessor.
Intel 8275	(Programmable CRT Controller) an Intel 8275 is a single chip device. Its function is to interface CRT raster scan display with the microcomputer.
Intel 8279	(Programmable Keyboard/display interface) The INTEL 8279 is a keyboard/Display controller specially developed for interfacing keyboard and display device to Intel 8085,8086 and 8088 microprocessor.

- **Other microcontroller and its applications -**

Microcontroller	Name of company	Size	Application
TMS 1000	Texas Instrument	4-bit	Toys control and applications
TLCS 47	Toshiba	4-bit	
MSM 6411	OKI	4-bit	
COP 420	National	4-bit	
87C 552	Philips	8-bit	Instrumentation and simple industrial control
TMS 7500	Texas Instruments	8-bit	
PIC 16C 6X	Microchip	8-bit	
6500	Rockwell's	8-bit	

- **RS-232 Interface :** Communication defined by RS-232 is serial data communication. There is a single wire or link, for each direction of data flow, and the bits of the message are sent in sequence once at a time.

  The RS-232 specification is intended to provide reliable communication up to a distance of soft, at rates up to 20,000 band. In RS-232 interface ASCII format is often used.

EXAM POINTS

- The byte of instruction XCHG is used to executed in 8085 microcontroller− **1**
- The bits of timer is used in 8051 microcontroller− **16 bits**
- The size of ROM uses in 8051 microcontroller is - **4 kb**
- The bit size of each temporary Internal Registers in 8051 is- **8 bit**
- The size of RAM in 8051 microcontroller is- **128 bytes**
- The _____ is ultraviolet light erasable and electrical programmable- **EPROM**
- In 8051 microcontroller, the flags are all stored in the .....− **PSW**
- In 8051 assembly language, the execution of ..... instruction affects the carry flag− **RRC A**
- In 8051 microcontroller programming, ... instruction is used to waste the time in a software timing loop− **NOP**
- ..... port are multifunctional for 8051 microcontroller- **Port 3 (Pins 10-17)**
- A device that converts output into a form that can be transmitted over a telephone line− **Modem**
- These devices provide a means of communication between a computer and outer world− **I/O Devices**
- The computer programme ..... converts statements written in high language to object code is known as− **Assembler**
- In 8051 microcontroller, on power-up, the memory address pointed by the stack pointer is− **07H**
- .....condition takes place when the microcontroller 8051 is reset− **SP=07H, P1 = FFH, RS0 = 0 RS1 = 0**
- In 8051 microcontroller two 16 bit SFRs is− **PC, DPTR**
- ..... MOV instructions of Microcontroller 8051 will show an error, i.e. Instruction is not valid− **MOV 80H, 92H**
- In 8051, Mode-1 for serial data communication means− **Standard UART mode**
- The main disadvantages of Assembly Languages is- **Assembly languages are machine-dependent**
- In 8051 microcontroller, ... instructions is an example of unconditional jump- **SJMP**
- Total number of 8-bit ports available in Microcontroller 8051 are - **4**
- ..... is used by the serial port to control data rates- **Register PCON**
- The timer on delay instruction is a three word instruction. Which is word- **Accumulator word 2, Preset word 1, Status word 0**
- _____ is used for execution of a program- **System memory**
- DPTR is a ..... bit register- **16**
- No member of 8051 family can access more than _____ bytes of opcode- **64K**
- The 8051 microcontroller has ____ math flags- **4**
- For ..... instructions are 9-bits involved in the rotation- **RRCA**

- For a 16-bit signed integer, SLC 500 counters can count within the range of- **–32,768 to +32,767**
- ..... address inputs are required to access 256 Bytes memory- **8**
- A standard baud rate is- **1200,4800,9600**
- 128-byte internal RAM of the 8051 Microcontroller, ... bytes are bit addressable- **16**
- TCP stands for - **Transmission Control Protocol**
- ..... multiple access technique is used by IEEE 802.11 standard for wireless LAN - **CSMA/CA**
- Bit B_3 in SCON register of 8051 microcontroller indicates- **Transmitted 9th Bit T**
- When the microcontroller executes some arithmetic operations, the flag bits of which register are effected- **PSW**
- It is needed to translate a high level program into a sequence of machine instructions that performs the desired task- **Compiler**
- In 8051 microcontroller, the register that holds the serial data interrupt bits TI and RI is- **SCON**
- A network device that bridges different networks- **Router**
- The total external data memory that can be interfaced to the 8051 is- **64K**
- The 8051 microcontroller can handle _____interrupt sources- **5**
- Memory is an equipment which stores- **Binary data**
- .....is a temporary storage area used by CPU to store relatively.....amount of data for internal computation and control- **Scratch Pad Area, small**
- Memory chip NOVRAM is- **Mixture of EEPROM and RAM**
- ..... media access methods works on first come first served basis- **CSMA/CD**
- In a binary number system, nibble means- **4 bits**
- In 8051 register which control full duplex serial data reception/transmission is .....- **SBUF**
- The first task of DOS operating system, after loading into the memory is to use the file called .....- **CONFIG.SYS**
- 8255 Mode 2 is known as- **Bidirectional bus mode**
- Inputs and outputs both are latched in- **Mode-1 and Mode-2**
- 8255 ..... does require hand shaking signals- **Mode-1 and Mode-2**
- Auto reload mode is allowed in which mode of the timer- **Mode-2**
- The value of the timer in Mode-0, Mode-1, and Mode-2- **1FFFH, FFFFH, 00FFH**
- ..... is an active-low chip select signal for enabling $\overline{RD}$ and $\overline{WR}$ operations of 8259- **$\overline{CS}$**
- The 8051 is a- **8-bit microcontroller**
- The Program counter in 8051 is ..... wide and it can address 64K code bytes- **16–bit**
- 8255 has ..... I/O pins which can be grouped in ..... parallel ports- **24, 3**
- In 8051 which interrupt has highest priority- **IE0**

- ..... has a third timer called Timer-2- **8052**
- ..... pins of a microcontroller are directly connected with 8255- **WR, RD,D_0-D_7**
- ..... pins are used to select the ports and the control register- **CS, A_1, A_0**
- The value of the control register when RESET button is set to zero then -
  Value remains the same as was before the RESET button was set to zero
- ..... is correct about the BSR mode -
  It is active low input used to select the individual Bits of the PORT C
- Signal conditioning is-
  Conversion or modification is referred to as conditioning
- ..... register bank is supposed to get selected if the values of register bank select bits RS1 and RS0 are detected to be '1' and '0' respectively- **Bank 2**
- ..... are the bits of the register PSW affected if we select Bank2 of 8051-
  PSW3 = 0 and PSW4 = 1
- If we push data into the stack then the stack pointer-
  Increases with every push
- On power up, the 8051 uses which RAM locations for register R_0–R_7- **00-07**
- The 8051 contains.- **4 banks of 8 registers**
- _____ is used to detect errors in signed arithmetic operations- **OV flag**
- Stack pointer in the 8051 is. **8 bit register**
- The 8051 contains - **Four 8 bit parallel ports**
- _____ pin is used to demultiplex address/ data bus- **ALE**
- 8051 devices have _____ on-chip program memory- **4 Kbytes**
- _____ pin is the external data memory write strobe in 8051- **P3.6**
- _____ pin is used to select external program ROM- **$\overline{PSEN}$**
- In 8051, a stack is implemented in -
  Internal RAM
- In a microcontroller, execution speed of a given program depends upon - **Clock frequency**
- Microcontrollers usually have-
  CPU, RAM+ROM, Peripherals
- CISC machines- **Use variable size instructions**
- RISC machines typically-
  Execute 1 instruction per clock cycle
- ..... is followed by general purpose microprocessors- **Von Neumann architecture**
- ..... supports Harvard architecture- **SHARC**
- Name the architecture and the instruction set for microcontroller-
  Harvard Architecture with CISC Instruction Set
- ..... of the two architecture saves memory-
  Von Neumann
- Harvard architecture has-
  Separate data and program memory
- An embedded microcontroller usually means-
  Microcontroller with all necessary resources available on-chip

- _____can understand the difference between instruction and data- **Microprocessor/controller**
- The variants of 8051 microcontroller differ in- **Amount of on-chip memory, Operating speed, On-chip peripherals**
- Embedded systems are tightly constrained with respect to- **Power consumption, Size , Constrained**
- Microcontroller based systems are usually- **Compact**
- _____is ROM less variant of the 8051- **8031**
- The most common examples of embedded systems are- **Washing machines , Cell phones , Digital clock**
- In the 8051, data can be stored in- **Code memory , Internal RAM, Stack memory**
- The program counter- **Stores the address of the next instruction to be executed**
- In the 8051, SP is _____ wide register, and may be initialized to point anywhere in the ___- **8 bit, on-chip 128 byte RAM**
- The address range of SFRs in the 8051 is- **80H-FFH**
- After power ON, the first byte read by the 8051 is- **Opcode**
- In a microcontroller the Program counter (PC) always deals with- **Program memory**
- A bit addressable SFR is - **ACC**
- When the 8051 is reset and the $\overline{EA}$ line is HIGH, the PC points to first program instruction in the- **Internal code memory**
- The stack operations in the 8051 are- **Last in first out (LIFO)**
- ..... pin of the 8051 is used to select external code memory- **$\overline{EA}$**
- LSB of byte address 21H has a bit address- **08H**
- ..... out of the four ports of 8051 needs a pull-up registor for using it is as an input or an output port- **PORT-0**
- ..... act as the 16 bit address lines for transferring data through it- **PORT-0 and PORT-2**
- ..... addressing mode is used in pushing or popping any data on the stack- **Direct**
- ..... operator is the most important while assigning any instruction as register indirect instruction- **@**
- The advantage of register indirect addressing mode is- **It uses the data dynamically**
- ..... devices are specifically being used for converting serial to parallel and from parallel to serial respectively- **Registers**
- The logic level understood by the micro-controller/micro-processor is- **TTL logic level**
- A null modem connection is- **The RXD of one is the TXD for the other**

- The function of the SCON register is- **To program the start bit, stop bit and data bits of framing**
- ..... should be done if we want to double the baud rate- **Change a bit of the PCON register**
- The clock source for the timers is- **From the crystal applied to the micro-controller**
- The frequency of the clock that is being used as the clock source for the timer is- **Controller's crystal frequency f /12**
- The function of the TMOD register is- **TMOD register is used to set different timer's or counter's to their appropriate modes**
- ..... steps are followed when we need to turn on any timer- **Load the TMOD register, load the count, start the timer, keep monitoring it, stop the timer**
- If Timer 0 is to be used as a counter, then at what particular pin clock pulse need to be applied- **P3.4**
- TF-1, TR-1, TF-0, TR-0 bits are of which register- **TCON**
- ..... types of architectures are available, for designing a device that is able to work on its own- **2**
- Registers $R_0 – R_3$ are used for what type of works- **They are used for arithmetic and logic instructions**
- The largest value that can be loaded in an 8-bit register is- **FFH**
- The total space for the data memory available in the AVR based microcontroller is- **FFFFH**
- In Assembler instructions directive is - **.EQU, .DEVICE, .ORG**
- A 14-bit program counter can execute a maximum of _____ memory locations- **16K**
- When AVR wakes up, then the value of PC becomes- **00000H**
- 8051 series of microcontrollers are made by ..... companies- **Atmel, Intel, Philips/Signetics**
- AT89C2051 has RAM of- **128 bytes**
- When 8051 wakes up then 0×00 is loaded to which register- **PC**
- SCON in serial port is used for which operation- **Controlling**
- Program counter stores what- **Address of the next instruction**
- Auxiliary carry is set during which condition- **When carry is generated from D_3 to D_4**
- Order of the assembly and running 8051 program is- **Myfile.asm, Myfile.lst, Myfile.obj, Myfile.hex**
- Why do we need a ULN2803 in driving a relay- **For increasing the current limit in the relays**
- In 8051 reset pin is provides by - **Pin-9**
- External Access is used to permit____- **Memory interfacing**
- Timer-0 is a_____ bit register- **16-bit**
- DAA command adds 6 to the nibble if- **Either CY or AC is '1'**
- If SUBB A, R_4 is executed, then actually what operation is being applied- **$A–R_4$**
- In 8-bit signed number operations, OV flag is set to 1 if- **A carry is generated from D_7 or D_6 bit**
- In unsigned number addition, the status of which bit is important- **CY**

- ANL instruction is used ___-
  To AND the contents of the two registers, To mask the status of the bits
- The external interrupts of 8051 can be enabled by-
  4 LSBs of TCON register , Interrupt enable , Priority register
- The bits that control the external interrupts are-
  EX0 and EX1
- EA bit is used to-
  Enable or disable all the interrupts
- The number of priority levels that each interrupt of 8051 have is- **2**
- The interrupt bit that when set works at level 1, and otherwise at level 0 is- **PT1, PT0, PX1**
- All the interrupts at level-1 are polled in the second clock cycle of the - **Fifth T state**
- ..... two pins for ground are available in ADC0804-
  For controlling the analog and the digital pins of the controller
- The function of the WR pin is-
  Its active low input used to inform ADC0804, about the start of conversion
- INTR, WR signal is an input/output signal pin-
  One is output and the other is input
- JZ, JNZ, DJNZ, JC, JNC instructions monitor the bits of which register- **PSW**
- When the CALL instruction is executed the topmost element of stack comes out to be-
  The address next to the call instruction
- LCALL instruction takes- **3-bytes**
- Are PUSH and POP instructions a type of CALL instructions- **No**
- The time taken by one machine cycle if crystal frequency is 20MHz is- **0.60 micro seconds**
- The 8051 has _____ 16-bit counter/timers - **2**
- Name the read only registers are present in the DS 12887- **Register C, Register D**
- The I/O ports that are used as address and data for external memory are - **Ports-0 and Ports-2**
- The 8051 has _____ parallel I/O ports- **4**
- Bit-addressable memory locations are-
  20H to 2FH
- The 8-bit address bus allows access to an address range of- **00 to FFH**
- The number of data registers is -___ **32**
- When the 8051 is reset and the $\overline{EA}$ line is LOW, the program counter points to the first program instruction in the- **External code memory**
- The total amount of external code memory that can be interfaced to the 8051 is- **64K**
- A HIGH on which pin resets the 8051 microcontroller- **RST**
- An alternate function of port pin P3.1 in the 8051 is- **Serial port output**
- An alternate function of port pin P3.0 (RXD) in the 8051 is - **Serial port input**
- ..... are the contents of the IE register, when the interrupt of the memory location 0X00 is caused-
  0X00H
- After RETI instruction is executed then the pointer will move to which location in the program-
  Next instruction of the program after the IE instruction

- ..... pin of the external hardware is said to exhibit INT0 interrupt- **pin no-12**
- ..... bit of the IE register is used to enable TXD/RXD interrupt- **IE.D4**
- The minimum no of cycles required for reset operation is- **1 cycle**
- PSEN stands for ____- **Program Store Enable**
- The operation for mode (1) is– **16 bit timer mode, 16 bit timer/counter THX and TLX are cascade, No Pre scalar**
- The operation for mode (3) is– **Split timer mode**
- Function of IE 1 in TCON register- **External interrupt-1 Edge flag. Not related to timer operations**
- General purpose memory is called as ____- **RAM memory**
- ..... timer register has both timers in it- **TMOD**
- Unlike microprocessors, microcontrollers make use of batteries because they have- **Low power consumption**
- The order decided by a processor or the CPU of a controller to execute an instruction is- **Fetch, Decode, Execute**
- Microcontrollers classified on the basis of internal bus width is- **4, 8, 16, 32 bits**
- Abbreviate CISC and RISC- **Complex Instruction Set Computer, Reduced Instruction Set Computer**
- The file extension that is loaded in a microcontroller for executing any instruction is- **.hex**
- Microcontrollers are called general purpose computers because- **They have built in RAM and ROM, they are cheap, they consume low power**
- ..... commands are used for addressing the off-chip data and associated codes respectively by data pointer- **MOVX & MOVC**
- If we say microcontroller is 8-bit then here 8-bit denotes size of- **ALU**
- A microcontroller at least should consist of - **CPU, RAM, ROM, I/O ports and timers**
- The upper 128 bytes of an internal data memory from 80H through FFH usually represent- **Special function registers**
- ..... location specify the storage/loading of vector address during the interrupt generation- **Program counter**
- ..... special function register play a vital role in the timer /counter made selection process by allocating the bits in it- **TMOD**
- It is not necessary to specify the baud rate to be equal to the number of bits per second because- **Each byte is preceded by a start bit & followed by one stop bit.**
- ..... is the feature of 16-bit micro-controller- **Large program & data memory spaces., High speed and I/O flexibility**
- ..... control signals is/are generated by timing and control unit of 8051 micro-controller in order to access the off-chip device apart from the internal timings- **ALE, PSEN, RD & WR**

- When we add two numbers the destination address must always be- **Accumulator**
- 8051 microcontroller is designed by Intel in- **1981**
- ..... register usually store the output generated by ALU is several arithmetic and logical operations- **Accumulator**
- ..... I/O Port can be used for higher address byte with addresses $A_8 – A_{15}$ **PORT 2**
- The addressing register for storing the 16 bit address can only be- **Data Pointer**
- The instruction, ADDA, R_7 is an example of - **Register instructions**
- ..... operations are performed by stack pointer during its incremental phase- **Push**
- ..... data memory control and handle the operation of several peripherals by assigning them in the category of special function registers- **Internal on-chip RAM**
- The speed accessibility of external data memory slower than internal on-chip RAM is- **Due to multiplexing of lower order byte of address data bus**
- ..... condition approve to prefer the EPROM / ROM versions for mass production in order to prevent the external memory connections- **Size of code < size of on-chip program memory**
- ..... registers can be utilized to write the programs by an effective selection of register bank in program status word (PSW)- **32**
- The only register without internal on-chip RAM address in MCS-51is- **Program counter**
- ..... kind of instructions usually affect the program counter- **CALL & JUMP**
- ..... bit play a significant role in the selection of a bank register of program status word (PSW)- **RS1, RS0**
- ..... flags represent the least significant bit (LSB) and most significant bit (MSB) of program status word (PSW) respectively- **Parity flag & Carry Flag.**
- HMI stand form is – **Human machine inferface**
- _____ are pre-defined words in a programming language whose meanings are known to the compiler of the language. **Keywords**
- ..... is not the function of SCADA- **Process Data**
- First time SCADA technology is used for - **Prediction of weather**
- Component of RTU is- **Communication Subsystem, Power Supply Subsystem, Memory**
- Which HMI component includes Visual display units, alphanumeric keyboard, cursor etc- **Operator console**
- Which represent a component of the SCADA system- **PLC, Human- Machine interface, RTU**
- Name the software developed by Siemens for SCADA- **WinCC**
- A Human-Machine Interface (HMI) is used for- **Allowing a user to interact with a device**

- Which part of the SCADA system initiates almost all communication with remote sites and interfaces with an operator-
MTU (Master Terminal Unit)
- Identify the software which is a HMI (Human Machine Interface) software package useful for SCADA-
Intelligence IFIX, RS view, simplicity
- Field devices are connected to.....modules for interfacing purpose- **Output**
- _____ gathers information from field device-
RTU
- OPC interfacing standard was developed during the years of- **1990**
- The full form of RAID is-
Redundant Array of Independent Disks
- The heart of a SCADA system is- **I/O task**
- The feature of SCADA is-
Control feature using a graphical representation
Alarm handling, Security Management

PREVIOUS YEA

1. Which step in the PLC process accepts the input data from the field device via an input
(a) Execute (b) Write
(c) Scan (d) Read
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Ans. (d) Read step in the PLC process accepts the input data from the field devices via an input.
The sequential process of PLC scan is-
Read → Execute →Write
or
Input scan→ Logic execution→ Output scan
PLC-A PLC stands for 'Programmable Logic controller'. It is a digital computer used to control machinery by constantly monitoring input and output devices.

2. 8051 Microcontroller has-
(a) 8-bit unidirectional address bus
(b) 16-bit unidirectional address bus
(c) 8-bit bidirectional address bus
(d) 16-bit bidirectional address bus
NIT Jamshedpur TA (EC) 22.04.2022

Ans. (b) : 8051 Microcontroller has 16-bit unidirectional address bus.
Features of 8051μC-
- It has 4 KB ROM and 128 byte RAM.
- It has 64 KB external code and data memory
- It has 8-bit ALU
- It has 5 interrupts, 2 external and 3internal.
- It has 2 timer/counter of 16 bits.
- It has four register banks.
- It has 64 KB on chip program memory.
- It has 32 general purpose registers each of 8-bit.
- It has 8 bit bidirectional data bus
- It has 16 bit unidirectional address bus.
- It has clock frequency upto 12MHz.

- The scripts in SCADA is- **Scripts are basically a function**
- CIMPLICITY is a- **SCADA Package**
- The full form of RTU is- **Remote Terminal Unit**
- The full form DDE is- **Dynamic Data Exchange**
- The difference between SCADA and HMI is- **HMI can be a part of SCADA but SCADA can't be a part of HMI**
- Control in SCADA is- **Supervisory Control**
- SCADA is- **Real time data acquisition and processing, Data Storing, Data monitoring and control**
- Components of a modern SCADA system- **Field devices, Controllers, remote I/Os and distributed I/Os, HMI, SCADA servers/clients**
- Why does SCADA software can communicate with many kinds of PLCs - **SCADA software supports popular PLC drives**

AR QUESTIONS

3. Programmable logic controller works on which mechanism?

(a) Parallel mechanism
(b) Sequential mechanism
(c) Both (a) and (b)
(d) None

ISRO SDSC TA (IN) 04.06.2022

Ans. (b) : Programmable logic controller works on sequential mechanism.
PLC(Programmable logic controller) were developed in the 1970s in order to replace hard-wired relay logic. They can be programmed or reprogrammed by using the ladder logic diagrams or other textual and graphical programming languages.

- First PLC was invented by 'Dick Morley' and first PLC model is 'MODICON 084'
- A PLC is microprocessor based device so, processor (CPU) is called as the brain of PLC.
- A PLC controller can be executed or operated by automatically or manually.
- PLC has become popular because of its timing and counting functions.

4. PLC timer whose timing value is not by loss of power is–

(a) ON delay timer
(b) OFF delay timer
(c) Non-retentive timer
(d) Retentive timer

ISRO SDSC TA (IN) 04.06.2022

Ans. (d) : PLC timer whose timing value is not by loss of power is retentive timer.
Timer in PLC-

- ON-delay timer.
- OFF-delay timer
- Retentive timer

Sequence of PLC scan cycle is-
Read → Execute→ Write or update output.

5. A process controller (PID) essentially is a–

(a) Amplifier (b) Clipper
(c) Sensor (d) Comparator

ISRO SDSC TA (IN) 04.06.2022

Ans. (d) : A process controller (PID) essentially is a comparator.

PID- A PID stands for proportional integral derivative. It is a fundamental feedback control mechanism for various systems.

PID control with PLC-

Many PLCs provides the PID calculation to determine the controller output as a standard routine.

6. What will be the command in an 8051 microcontroller to initialize port P2.0 to P2.3 as Input port and P2.4 to P2.7 as Output port?

(a) P2 =0XF0; (b) P2 =0XFF;
(c) P2 =0X0F; (d) P2 = 0X00;

CSPHCL 13.01.2022

Ans. (a) : P2= 0XF0; will be the command in an 8051 microcontroller to initialize port P2.0 to P2.3 as Input port and P2.4 to P2.7 as Output port.

Port 2 pin structure- Port-2 has 8-pins (P2.0 to P2.7). Port 2 is used for higher external address byte or a normal input/ output port.

7. In signal transmission and recording, _____ time is the time required for a PLC to complete one I/O scan plus the execution cycle.

(a) scan (b) total
(c) execution (d) I/O propagation

UPRVUNL JE 14.05.2022

Ans. (a) : In signal transmission and recording, scan time is the time required for a PLC to complete one I/O scan plus the execution cycle.

- For PLC the sequence of scan is read, execute and write.
- A PLC is a microprocessor based device so, CPU is called as a brain of PLC, and the primary function of CPU is to read input, control and update output.

8. 8051 is a _____ pin microcontroller.

(a) 51 (b) 42
(c) 40 (d) 16

UPRVUNL JE 14.05.2022

Ans. (c) : 8051 is a 40 pin microcontroller.

Features of 8051 microcontroller-

- Total external data memory-64KB
- Total internal data memory-128 bytes
- Total internal code memory - 4KB.
- Total 5 interrupt 2 external and 3 internal.
- 2 timer/counter of 16 bits.
- 12 MHz clock frequency.
- 64 KB on chip memory.
- 8-bit ALU
- 64 KB external code memory.
- 32 I/O pins

9. TMOD, PCON are _____ registers in 8051 microcontroller.

(a) control
(b) serial data transmitter
(c) timer
(d) serial data receiver

UPRVUNL JE 14.05.2022

Ans. (a) : TMOD, PCON are control registers in 8051 microcontroller.

TMOD(Timer Mode)- It is used to set the operating modes of the timer T0 and T1. The lower four bits are used to configure timer 0 and the higher four bits are used to configure timer 1.

	0	0	0	0	0	0	0	(Value on RESET)
TMOD	GATE1	C/T1	T1M1	GATE0	C/T0	T0M1	T0M0	Address =89H
	MSB						LSB	

PCON (Power control)- It is used to control the 8051 microcontroller's power mode and is located at 87H of the SFR memory space.

PCON	SMOD	.....	.....	GF1	GF0	PD	IOL
	MSB						LSB

10. 8051 microcontrollers has internal RAM of _____ and ROM of _____.

(a) 1K bytes, 64 bytes (b) 128 bytes, 4K bytes
(c) 4K bytes, 128 bytes (d) 64 bytes, 1K bytes

UPRVUNL JE 14.05.2022

Ans. (b) : 8051 microcontroller has internal RAM of 128 bytes and ROM of 4K bytes.

Important features of 8051 microcontroller-

- Total external data memory – 64KB
- External code memory and on chip memory-64KB.
- Clock frequency-12MHz.
- 16 bits timer / counter-2
- I/O pins - 32
- Total interrupts-5
- Total flags- 6

11. In microcontrollers, DPTR stands for _____.

(a) data pointer
(b) double data pointer
(c) double pointer
(d) data counting pointer

UPRVUNL JE 14.05.2022

Ans. (a) : In microcontroller, DPTR stands for data pointer.

DPTR(Data pointer)- The DPTR register is made up of two 8-bit registers i.e. it contains 16 bit register.

In 8051 microcontroller-

- DPTR- Data pointer
- PSW - Program status word.
- PCON- Power control.
- SCON- Serial control.
- TMOD- Timer Mode.
- TCON- Timer control.

12. The number 15 in the PLC output address format 0 :4/15 represents _____

(a) terminal (b) file number
(c) bit (d) subelement number

HPCL MT (IN) 07.08.2022

Ans. (a) : The number 15 in the PLC output address formate 0:4/15 represents terminal.

PLC (Programmable Logic Controller)-

It is a microprocessor based solid state rugged construction hardware device.

It is specially a digitalized computer which can be programmed or reprogrammed by programmer.

13. In SCADA system, the DNP refers to _____

(a) Distributed Network Protocol
(b) Duplex Network Protocol
(c) Demand Network Protocol
(d) Decentralized Network Protocol

HPCL MT (IN) 07.08.2022

Ans. (a) : In SCADA system, the DNP refers to distributed network protocol.

SCADA-It stands for 'Supervisory Control and Data Acquistion'. SCADA is a software which is used to control and monitor the system.

Use of SCADA-

- Food processing industry.
- Oil and gas control system.
- Manufacturing plants.

DNP-It stands for 'Distributed Network Protocol'. It is a set of communications protocols used between components in process automation system. It is usually used in water and electric companies.

DNP plays a crucial role in SCADA systems.

14. Which one of the following circuits is used to protect the output module of a PLC from large loads?

(a) interposing relay (b) LED
(c) Push button (d) buzzer

HPCL MT (IN) 07.08.2022

Ans. (a) : Interposing relay circuit is used to protect the output module of a PLC from large loads.

Interposing relay- It is electromagnetic relay used to send/ receive digital signal through hardwired systems. Interposing relay normally consists of a coil that is energied by either AC or DC power and activates contacts that are used to trigger another circuit.

15. Which BEST describes a Programmable Logic Controller?

(a) A safety interlocking device vital to the performance of machine guarding
(b) A digital computer used for automation of electromechanical processes
(c) Preferred substitute for analog and digital transmitters on radiological equipment
(d) Series and paralleled relays used to denote changes in process level and flow

ISRO PC TA (EC) 10.04.2022

Ans. (b) : A programmable logic controller is a digital computer used for automation of electromechanical processes.

Important points of PLCs are-

- First PLC was invented by Dick Morley.
- First PLC model is 'MODICON 084'
- First commercial PLC was invented by 'Michael Greenburg' which model is '184'.
- A PLC is a solid state rugged construction hardware device.

16. 8051 has _____ special function registers.

(a) 21 (b) 16
(c) 8 (d) 11

UPPCL JE (E&T) 25.03.2021, Shift-I

Ans. (a) : 8051 has 21 special function registers.

Features of 8051 microcontroller-

- 32 general purpose registers each of 8-bit
- Internal ROM memory -4kB.

- Internal RAM memory - 128 bytes.
- No. of 2 Timer and counter - 16-bit.
- Data bus- 8-bit.
- Address bus - 16-bit.
- Total interrupt- 5.
- Program counter- 16-bit.

17. Sensors contain ……

(a) ABC (b) ADC
(c) DAC (d) XYZ

NFL 17.12.2021

Ans. (b) : Sensors contain ADC.

ADC (Analog to digital converters)- It is used to convert analog signal to digital signals. A analog to digital converter (ADC) is very useful feature that converts an analog voltage on a pin to a digital number.

Sensors- Sensors are tools that detect and respond to some type of input from the physical environment.

18. Find the odd one from the following.

(a) Stand-Alone Embedded Systems
(b) Real Time Embedded Systems
(c) Static Embedded Systems
(d) Networked embedded Systems

UPPCL JE (T&E) 25.03.2021, Shift-II

Ans. (c) : Stand-Alone Embedded Systems- It is independent system which can work by themselves. They don't depend on a host system. It takes input in digital or analog form and provides the output.

Real-Time Embedded Systems- It is strictly time specific which means these embedded systems provides output in a particular time interval.

Networked Embedded Systems- These are connected to a network which may be wired or wireless to provide output to the attached device. They communicate with embedded web server through network.

19. What is the number of priority levels for each interrupt in 8051?

(a) 4 (b) 6
(c) 2 (d) 8

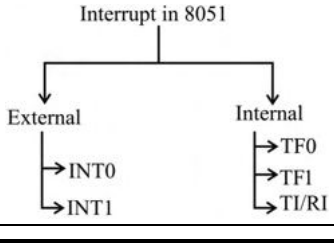
UPRVUNL JE (E &M) 01.11.2021

Ans. (c) : The number of priority levels for each interrupt in 8051 is 2.

Priority levels for each interrupt in 8051 may be 1 or 0 i.e. high or low.

Interrupt- An interrupt is an even that occurs randomly in the flow of continuity. It is just like a call which you have when you are busy with some work and depending upon call priority you decide whether to attend or neglect it.

There are 5 interrupt in 8051 microcontroller-



20. Which unit of SCADA is used to collecting the data and store the data in database, provide the interface to operator and send the information to other system?

(a) HMI (Human Machine Interface)
(b) RTU(Remote Terminal Unit)
(c) FPDD(Flat Panel Display Device)
(d) MTU(Master Terminal Unit)

UPRVUNL JE (E &M) 01.11.2021

Ans. (d) : MTU (Master Terminal Unit) of SCADA is used to collecting the data and store the data in database, provide the interface to operator and send the information to other system.

Master Terminal Unit (MTU)- MTU in SCADA System is a device that issues the commands to the RTU (Remote Terminal Unit) which are located at remote places from the control. The communication between the MTU and RTU is bidirectional.

- An RTU simply collects the data from the field and stores the data.
- In SCADA system, MTU acts as the heart of the system.

21. Important micro controller sources are ……..

(a) Intel, Motorola, and Phillips
(b) Harvard and Princeton
(c) Intel, Philips, Motorola, Harvard and Princeton
(d) Motorola, Intel and Harvard

NFL 17.12.2021

Ans. (c) : Important microcontroller sources are:-

- Intel
- Motorola
- Philips
- Harvard
- Princeton.

22. A microcontroller should consist of at least ……..

(a) CPU, RAM, ROM, I/O ports and times
(b) RAM/ROM, I/O ports and timers
(c) CPU, ROM, I/O ports and timers
(d) CPU, RAM, I/O ports and timers

NFL 17.12.2021

Ans. (a) : A microcontroller should consist of at least CPU, RAM, ROM, I/O ports and timers.

- Microcontroller is based on Harvard architecture.
- Microcontroller is an embedded system.
- Microcontroller is inexpensive and straight forward with fewer instructions to process.
- It has 5 interrupts.
- It has 6 flags.

23. A PLC is a computer specially designed to operate reliably under harsh industrial environments such as extreme temperatures, wet, dry, and/or dusty conditions. What is the full form of PLC?

(a) Programmable Logic Controller
(b) Programmable Logic Computer
(c) Professional Logic Controller
(d) Professional Logic Computer

UPPCL JE (E&T) 25.03.2021, Shift-I

Ans. (a) : A PLC is a computer specially designed to operate reliably under harsh industrial environments such as extreme temperatures, wet, dry and dusty conditions.

Programable Logic Controller (PLC)- PLC is such a physical device which controls industrial operation automatically with the help of logic program i.e. a PLC is a digitalized computer which can be programmed or reprogrammed by programmer.

Note:-

- First PLC was invented by 'Dick Morley' in 1964.
- First PLC model is 'MODICON 084'.
- First commercial PLC was invented by 'Michael Greenburg' in 1973, which model is 184.

24. Sheetal has a 1-year old son who plays with Robot. She has installed CCTV in her house for her son's safety. She washed her clothes in an automatic washing machine and uses Gas Tandoor to bake a cake for her son.
Which is not an application of microcontroller?

(a) Gas Tandoor
(b) CCTV
(c) Robot
(d) Automatic washing machine

UPPCL JE (E&T) 25.03.2021, Shift-I

Ans. (a) : Sheetal has a 1-year old son who plays with Robot. She has installed CCTV in her house for her son's safety. She washed her clothes in an automatic washing machine and uses Gas Tandoor to bake a cake for her son here Gas Tandoor is not an application of microcontroller.

Following are the application of microcontroller-

- CCTV
- Robot
- Automatic washing machine.

Microcontroller- A microcontroller is a VLSI IC that contains a processor (CPU) along with some other peripherals like memory (RAM and ROM), timer/counter, communication interface etc.

25. Identify the false statements from the following.

(a) Microprocessor is used in personal computers whereas microcontroller is used in an embedded system
(b) Microcontroller consists of only a central processing unit, whereas microprocessor contain a CPU, Memory, I/O all integrated into one chip.
(c) Microprocessor uses an external bus to interface to RAM, ROM and other peripherals on the other hand microcontroller uses an internal controlling bus.
(d) Microprocessor is complicated and expensive, but microcontroller is inexpensive and straight forward.

UPPCL JE (E&T) 25.03.2021, Shift-I

Ans. (b) : Comparison between microprocessor and microcontroller-

Microprocessor	Microcontroller
• It is used in personal computers.	• It is used in an embedded system.
• Microprocessor consists of only a CPU (Central processing unit)	• Microcontroller contains a CPU, memory, I/O all integrated into one chip.
• Microprocessor uses an external bus to interface RAM, ROM and other peripherals.	• Microcontroller uses an internal controlling bus.
• Microprocessor is complicated and expensive, with large number of instructions to process.	• Microcontroller is inexpensive and straight forward with fewer instructions to process.
• It is based on Von Neumann model	• It is based on Harvard architecture.

26. In the year 1993, _____ introduced the first microcontroller using flash memory.

(a) Intel (b) Atmel
(c) Alchemist (d) Ericson

UPPCL JE (T&E) 25.03.2021, Shift-II

Ans. (b) : In the year 1993, Atmel introduced the first microcontroller using flash memory.
The Atmel AT Mega 164 is equipped with 131 RISC type instructions.

27. Which of the following instrument control busses is called IEEE-488 bus?

(a) GPIB (b) Ethernet
(c) PCI (d) USB

(1) UPMRC (SCTO) 14.04.2021

Ans. (a) : GPIB instrument control busses is called IEEE-488 bus.
IEEE 488 Bus (GPIB)- It is an 8-bit parallel multi-master interface bus that is used for short distance communications. IEEE 488 bus allows different controllers to share a similar bus whereas only one controller will be active at any specific time.
GPIB bus consists of eight data lines in order to transmit 8 bits of data at a single instance.

(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(10)	(11) A	(12) A	(13) GPIB Primary Address.				

28. In which of the following modes in 8255A PPI can port A be used as a bidirectional data bus?

(a) BSR mode (b) Mode 1
(c) Mode 2 (d) Mode 0

UPMRC (SCTO) 14.04.2021

Ans. (c) : In mode 2, modes 8255A PPI can port A be used as a bidirectional data bus.
The 8255A is a general purpose programmable I/O device designed to transfer the data from I/O to interrupt I/O under certain conditions as required. It can be used with almost any microprocessor.
PPI→ Programmable peripheral interface.
Features of 8255A-
- It is consists of PA, PB and PC.
- It has 3 modes, mode 0, mode 1 and mode 2.
- It has improve DC driving capability
- Address/ data bus must be externally demuxed.

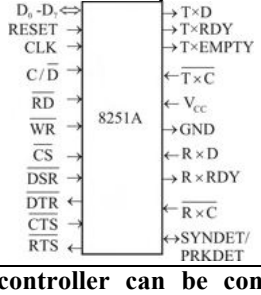
29. The 8251A programmable communication chip is designed for:

(a) synchronous and asynchronous serial data communication
(b) synchronous and asynchronous parallel data communication
(c) synchronous parallel data communication only
(d) synchronous serial data communication only

UPMRC (SCTO) 14.04.2021

Ans. (a) : The 8251A programmable communication chip is designed for synchronous and asynchronous serials data communication.
The 8251 chip is an universal synchronous asynchronous receiver transmitter (USART)
8251A acts as a mediator between the microprocessor and peripheral devices. It converts serial data to parallel form and vice versa.

Pin description of 8251 A chip-



30. A microcontroller can be considered a self-contained system with a processor, _____and peripherals, and can be used as an embedded system.
Choose the most appropriate option.

(a) Keyboard (b) Tester
(c) Memory (d) Pre-processor

UPPCL JE (T&E) 25.03.2021, Shift-II

Ans. (c) : A microcontroller can be considered as self-contained system with a processor, memory and peripherals, and can be used as an embedded system.
Microcontroller is an embedded system based on Harward architecture. It uses an internal controlling bus. Microcontroller is inexpensive and straight forward with fewer instructions to process.

31. The Atmel ATMega164 is equipped with _____ RISC-type instructions.

(a) 84 (b) 125
(c) 131 (d) 120

UPPCL JE (T&E) 25.03.2021, Shift-II

Ans. (c) : The Atmel ATMega164 is equipped with 131 RISC-type instructions.
In the year 1993, Atmel introduced the first microcontroller using flash memory.
Atmel ATMega164 has the following features-

- 8 bit processing (8-bit microcontroller)
- It contains 131 powerful instruction.
- Its operating frequency is 16 MHz.
- It has 32 inbuilt registers.

32. To configure port A and port B as output ports, port C not being used in the 8155 programmable interface, the control word should have the value:

(a) 03H (b) 01H
(c) 02H (d) 60H

MRPL (TA)- 2021

Ans. (a) : To configure port A and port B as output ports, port C not being used in the 8155 programmable interface, the control word should have the value 03H.

- 8155 is a programmable peripheral interface.
- 8085 can send data to 8155 using data bus.
- A command or instruction for 8155 is also called control word.
- Control word of 8155 is 8 bit.
- 8155 can be easily interfaced with 8085 microprocessor
- The timer of 8155 consists of a 14 bit counter and operates in 4 modes.

33. Which of the following instruction is used to get the 1's complement of the operand in a ARM controller.

(a) COMP (b) BIC
(c) CMP (d) MVN

MRPL (TA)- 2021

Ans. (d) : MVN instruction is used to get the 1's complement of the operand in a ARM controller.
MVN stand for move NOT.
Move NOT (MVN)-
Move the NOT of the 32 bit value into a register Rd.
Ex:-

MVN R1, R0	; R1← NOT R0
MVN R1, R0, LSL #2	; R1← NOT (R0*4)
MVN R0, #4	; R0← NOT 4

After movement original contents of source register will remain same.

34. In a microcontroller:

(a) One machine cycle is equal to one clock cycle
(b) One clock cycle consists of several machine cycles
(c) One machine cycle consists of several clock cycles
(d) One machine cycle is always less than one clock cycle

MRPL (TA)- 2021

Ans. (b) : In a microcontroller one clock cycle consists of several machine cycles.
Machine cycle-
To execute an instruction microcontroller takes certain number of cycles these cycles are called machine cycles. The length of machine cycles depend on frequency depending on microcontroller.
Instruction cycle = Fetch cycle + Execute cycle.

35. Which of the following peripherals provide I/O facilities?

i. 8279 **ii. 8155**
iii. 8259 **iv. 8255**

(a) i, ii (b) ii, iii
(c) iii, iv (d) ii, iv

MRPL (TA)- 2021

Ans. (d) : 8155 and 8255 peripherals provide I/O facilities.

- 8155 is a programmable peripheral Interface.
- 8155 can be easily interfaced with 8085 microprocessor.
- 8255 is a programmable parallel I/O device.
- 8255 is consists of 3-bit I/O ports i.e. PA, PB and PC

36. The main importance of ARM micro-processors is providing operation with:

(a) Low cost and low power consumption

(b) Higher degree of multi-tasking
(c) Lower error or glitches
(d) Efficient memory managemen

MRPL (TA)- 2021

Ans. (a) : The main importance of ARM microprocessors is providing operation with low cost and low power consumption.

- ARM stands for advanced RISC Machine.
- ARM processors were basically designed for mobile systems.
- ARM processor support byte addressability.

37. Memory can be accessed in ARM systems by which of these instructions:

i. Store ii. MOVE
iii. Load iv. arithmetic
v. logical

(a) i,ii,iii (b) i, ii
(c) i, iv, v (d) iii, iv, v

MRPL (TA)- 2021

Ans. (b) : Memory can be accessed in ARM systems by store and move instructions.

- ARM stands for advanced RISC machines.
- RISC stands for reduced instruction set computer.
- In ARM, PC is implemented using general purpose register.
- All instructions in ARM are conditionally executed.

ARM architectures represent a different approach to how the hardware for system is designed when compared to more familiar server architectures like X86.

38. A good application for a timed interrupt in a PLC program would be:

(a) A communications function block
(b) A PID function block
(c) A math function block
(d) A motor start /stop rung

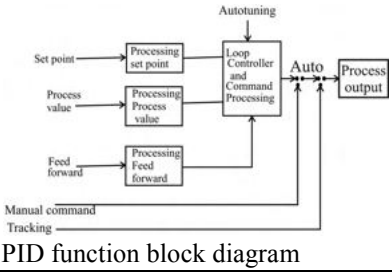
MRPL (TA)- 2021

Ans. (b) : A good application for a timed interrupt in a PLC program would be a PID function block.

PID (Proportional Integral Derivative)-

PID control is a fundamental feedback control mechanism for various systems.

PID function block perform initialization in the first program cycle of the PLC program. Therefore they must be called in the main program task, otherwise the initialization fails.



PID function block diagram

39. The period of machine cycle of an 8051 based system with crystal frequency 16 MHz is

(a) 0.25 μs (b) 0.5 μs
(c) 0.75 μs (d) 1 μs

ISRO LPSC TA (EC) 23.02.2020

Ans (c) : Microcontroller 8051 has 12 pulse in one machine cycle

Given, f = 16 MHz

Hence, frequency of one machine cycle

$$= \frac{16\,\text{MHz}}{12} = 1.3\ \text{MHz}$$

Time taken by one machine cycle $= \dfrac{1}{1.33\ \text{MHz}}$

$= 0.75\ \mu s$

40. Which of the following type of network is used to cover small geographical area?

(a) LAN (b) MAN

(c) VAN (d) WAN

RRB JE- 01.09.2019

Ans. (a) : LAN type of network is used to cover small geographical area.

LAN (Local area network)- A local area network (LAN) is a computer network that interconnects to computers in a limited area such as home, school, computer laboratory etc.

Type of computer networks-

- LAN (Local Area Network)
- WAN (Wide Area Network)
- MAN (Metropolitan Area Network)
- PAN (Personal Area Network)

41. In PLC, 'FRD' instruction does the following operation

(a) Converts Integer value to BCD value

(b) Converts HEX value to Binary value

(c) Converts BCD value to HEX value

(d) Converts BCD value to Integer value

ISRO URSC TA (EC) 24.03.2019

Ans : (d) In PLC, 'FRD' instruction converts BCD value to integer value.

FRD instruction-A decimal number is sent to the PLC as BCD equivalent and the PLC software uses an instruction to convert it to a binary value that matches with the decimal number.

The definition of the FRD instruction is an instruction, that is used to convert the BCD value to integer value and then place the results in the destination. The integer number is stored as a binary number inside the software. FRD is a block type instruction and it has two parameters like source and destination.

42. 'SQL' instruction in PLC is

(a) An input instruction and used to monitor machine operating conditions

(b) An output instruction and checks a sequencer file to control output devices

(c) An output instruction and captures reference conditions by manually stepping the machine through its operating sequences

(d) An input instruction and used for logic querying

ISRO URSC TA (EC) 24.03.2019

Ans : (c) 'SQL' instruction in PLC is an output instruction and capture reference conditions by manually stepping the machine through its operating sequences.

SQL instruction- SQL stands for sequencer load. SQL functions collect the input data from the input modules and stores in the memory data i.e. SQL is used to read the PLC input module and store the input data in a file.

43. Of the 128-byte internal RAM of the 8051 Microcontroller, how many bytes are bit addressable?

(a) 4 bytes (b) 16 bytes
(c) 32 bytes (d) 64 bytes

ISRO URSC TA (EC) 24.03.2019

Ans : (b) Of the 128-byte internal RAM of the 8051 Microcontroller, 16 bytes are bit addressable.

Microcontroller- A microcontroller is a compact integrated circuit designed to govern a specific operation in a embedded system. A typical microcontroller includes a processer, memory and input/ output peripherals on a single chip.

In an 8051 microcontroller-

- Internal RAM→ 128 bytes
- Internal ROM → 4 kB
- No. of interrupts → 5
- Timer/counter→2
- Flags →6

44. When 8051 Microcontroller is powered up, the stack pointer contains the value

(a) 00H (b) FFH (c) 01H (d) 07H

ISRO URSC TA (EC) 24.03.2019

Ans : (d) When 8051 microcontroller is powered up, the stack pointer contains the value 07H.

When the 8051 microcontroller is reset, the stack pointer is set to address 07H. It means the stack area will begin at address 08H.

Stack-It is the section of RAM used by the CPU to store information temporarily.

45. An IC that transforms parallel data to serial in the asynchronous format and vice versa

(a) UART (b) USART
(c) MODEM (d) RS232C

ISRO : PCM TA (EC) 21.04.2018

Ans. (a) An IC that transforms parallel data to serial in the synchronous format and vice-versa is UART.

UART-It stands for universal asynchronous receiver transmitter. It is one of the simplest and oldest forms of device to device digital communication.

UART is one of the most generally used serial communication techniques. UART is being used in several applications like GPS, receivers, Bluetooth modules and wireless communication system.

46. In an embedded system the use of actuator is

(a) for control action
(b) for scanning various parameters
(c) for data storing
(d) for measurement

UPPCL JE Telecommunication 2013

Ans : (a) In an embedded system the use of actuator is for control action.

In embedded systems, the control signal comes from a microcontroller programmed by software. An actuator is a device that moves or controls some mechanism. An actuator turns a control signal into mechanical action such as an electric motor.

47. P-controller is used where

(a) process variable is constant
(b) process variables changes rapidly

(c) process variables changes slowly
(d) process variable increases slowly but decreases rapidly

UPPCL JE Telecommunication 2013

Ans : (c) P-controller is used where process variables changes rapidly.
P-controller-It is mostly used in first order processes with single energy storage to stabilize the unstable process. the main use of the P controller is to decrease the steady state error of the system.
- The transfer function of P-controller is K_P.
- System stability decreases as P-controller overshoot increases.

48. Microcontroller contains
(a) Processor and Timers
(b) Processor and I/O devices
(c) Processor only
(d) Processor Memory Timers and I/O devices

UPPCL JE Trainee–2014
UPPCL JE Telecommunication 2013

Ans : (d) Microcontroller contains processor, memory, timers and I/O devices.
Microcontroller-A microcontroller is a small or compact device which is designed to perform the specific tasks of embedded systems.
The general microcontroller consists of the processor, memory (RAM, ROM), serial ports, peripherals (timers, counters) etc.
- Internal RAM of 8051μC → 128 bytes.
- Internal ROM of 8051μC → 4kB.

49. Which of the following device is not an example of embedded system?
(a) Mobile (b) Microprocessor
(c) Digital camera (d) Tablet

UPPCL JE Telecommunication 2013

Ans : (b) Microprocessor device is not an example of embedded system.
Embedded system-An embedded system is a combination of hardware and software designed for a specific task, this system can be programmable or have a fixed functionality.
An embedded system contains CPU, RAM, ROM etc.

50. In an embedded system-
(a) must have Processor ROM and RAM
(b) must have hard disk
(c) must have processor and I/P
(d) must have processor and ROM

UPPCL JE Telecommunication 2013

Ans : (a) In an embedded system it must have processor, ROM and RAM.
Advantages of embedded systems-
- It has fast operation
- It has low power operation.
- It is highly reliable.
- It has very few interconnections.

There are three types of embedded systems-
- Small scale.
- Medium scale.
- Sophisticated.

Applications of embedded systems-
- Robotic science
- Automotive
- Automobiles
- Home devices

51. If a 24 MHz Oscillator is used in 8051 microcontroller, the time taken for Timer to make one increment

(a) 1 μ sec (b) 2 μ sec
(c) 0.5 μ sec (d) 0.24 μ sec

ISRO:SCB TA (EC) 20.08.2017

Ans : (c) Timer clock frequency $= \frac{1}{12} \times f$

$= \frac{1}{12} \times 24\,\text{MHz}$

$= 2$ MHz

Hence, time taken by timer to one increment-

$$T = \frac{1}{\text{Timer frequency}} = \frac{1}{2\text{MHz}}$$

$$\boxed{T = 0.5\,\mu s}$$

52. In 8051 microcontroller, which of the following statements is TRUE?

(a) Stack Pointer Direct address is 80H and it is only Bit addressable
(b) Stack Pointer Direct address is 90H and it is only Byte addressable
(c) Stack Pointer Direct address is 81H and it is only Bit addressable
(d) Stack Pointer Direct address is 81H and it is only Byte addressable

ISRO:SCB TA (EC) 20.08.2017

Ans : (d) In 8051 microcontroller, stack pointer direct address is 81H and it is only byte addressable.

- Stack pointer holds 8-bit address while program counter 16-bit.
- The integral RAM memory of the 8051μC is 128 bytes.
- The 8051 has two, 16-bit counter/timers.
- The address space of the 8051 is divided into four distinct areas as-

1. Internal data.
2. External data.
3. Internal code.
4. External code.

53 When the microcontroller executes some arithmetic operations, the flag bits of which register are effected?

(a) PSW (b) SP
(c) DPTR (d) PC

ISRO: SDSC TA (EC) 12.02.2017

Ans.(a): When the microcontroller executes some arithmetic operations, the flag bits of PSW register are affected.

Like any other microprocessor, the 8051 microcontroller also has a flag register to indicate arithmetic conditions such as the carry bit.

The flag register in the 8051 microcontroller is known as program status word (PWS) register.

Program status word (PSW)- It is an 8-bit register. It is also referred as flag register. These flags indicates the status of the current result. They are changed by the ALU after every arithmetic and logic operation these flags can also be changed by programmer PSW is a bit addressable register in which each bit can be individually changed by the programmer.

54. In 8051 microcontroller, the register that holds the serial data interrupt bits TI and RI is

(a) SMOD (b) SCON
(c) PCON (d) IE

ISRO SCB TA (EC) 13.11.2016

Ans. (b) In 8051 microcontroller, the register that holds the serial data interrupt bits TI and RI is SCON. In 8051 microcontroller, SCON stands for Serial Control.
In SCON register TI is Transmitting Interrupt flag while RI is Receiving Interrupt flag.
Bit B3 in SCON register of 8051 microcontroller indicates transmitted 9th bit.

55. The 8051 can handle _____interrupt sources

(a) 3 (b) 4
(c) 6 (d) 5

ISRO: LPSC TA (EC) 07.08.20

Ans : (d) The 8051 can handle 5 interrupt sources.
There are 5 interrupts in 8051 microcontroller, two external interrupts and three internal interrupts.

Interrupt source	Interrupt Bit/Flag
External Interrupt 0	INT 0
External Interrupt 1	INT 1
Timer Interrupt 0	TF 0
Timer Interrupt 1	TF 1
Serial Interrupt	TI/RI

Note:- External Interrupt 0 has the highest priority while serial interrupt (Internal interrupt) has lowest priority in 8051 microcontroller.

56. The total external data memory that can be interfaced to the 8051 is:

(a) 32K (b) 64K
(c) 128K (d) 256K

ISRO: LPSC TA (EC) 07.08.2016
RRB JE- 01.09.2019

Ans : (b) The total external data memory that can be interfaced to the 8051 is 64K.

Microcontroller 8051-

- Internal RAM→ 128 bytes
- Internal ROM → 4KB
- No. of interrupts → 5
- Timer/counter →2

Note:- In 8051 microcontroller internal RAM is known as data memory while internal ROM as code memory.

57. Which of the following computation will take minimum number of clock cycles, if it is implemented on 8051 micro-controller? Following is variable declaration in c code:
unsigned int a, b:

(a) b = a*a (b) b = a*3
(c) b = a/3 (d) b = a/4

ISRO 2014

Ans : (d) b=a/4 computation will take minimum number of clock cycles, if it is implemented on 8051 micro-controller

Some computations are-

- b = a*a : You have to use MUL, you have no choice >4 cycles.
- b = a*3 : You can do it with two additions.
  a + a + a > 2cycles.
- b = a/3 : You have to use DIV > 4 Cycles.
- b = a/4: You can use RRC + twice > 2 cycle.

58. Which instruction of 8051 microcontroller is used for reading data from code memory?

(a) MOV (b) MOV C
(c) MOV X (d) XC H

ISRO 2014

Ans : (b) MOVC instruction of 8051 microcontroller is used for reading data from code memory.

Microcontroller-

A microcontroller is a VLSI IC that contains a processor (CPU) along with some other peripherals like memory (RAM and ROM), timer/counter, communication interface, ADC etc.

Features of 8051 microcontroller-

- It is an 8-bit microcontroller.
- Internal data memory (Internal RAM)→128 bytes
- External data memory →64K
- Internal code memory (Internal ROM)→4KB.
- It has two timer/counter of 16 bit.

59. Which of the following addressing mode is not usable in XCH instruction of 8051 microcontroller?

(a) Direct Addressing
(b) Indirect Addressing
(c) Register Addressing
(d) Immediate Addressing

ISRO 2015

Ans : (d) Immediate addressing mode is not usable in XCH instruction of 8051 microcontroller.

The XCH operation and the possible modes are listed below the table:

Instructions	Opcode	Bytes	Cycles	Flags
XCH A, @R0	0× C6	1	1	None
XCH A, @R1	0×C7	1	1	None
XCH A, R0	0×C8	1	1	None
XCH A, R1	0×C9	1	1	None
XCH A, R2	0×CA	1	1	None
XCH A, R3	0×CB	1	1	None
XCH A, R4	0×CC	1	1	None
XCH A, R5	0×CD	1	1	None
XCH A, R6	0×CE	1	1	None
XCH A, R7	0×CF	1	1	None
XCH A, iram address	0×C5	2	1	None

60. Suppose that the same clock signal is used to increment the microprogram counter and to load the control register. Which of the following assertion(s) is/are true?

1. Microinstruction execution time is at least two clock periods.
2. Microinstruction execution time can be overlapped with fetching the next micro instruction.
3. Unconditional branch microinstructions must necessarily take longer than other types.

(a) 1 only (b) 2 only
(c) 1 and 3 (d) 2 and 3

BSNL (JTO)–2006

Ans : (d) Suppose that the same clock signal is used to increment the micro program counter and to load the control register following assertion are true.

- Microinstruction execution time can be overlapped with fetching the next micro instruction.
- Unconditional branch microinstructions must necessarily take longer than other types.

61. When the 8051 is reset and the line in HIGH, the program counter points to the first program instruction in the:

(a) internal code memory
(b) external code memory
(c) internal data memory
(d) external data memory

(ISRO Electronic, 2016)

Ans : (a) When the 8051 is reset and the line is HIGH, the program counter points to the first program instruction in the internal code memory.

When the 8051 microcontroller is reset and the EA line is LOW, the program counter points to the first program instruction in the 'external code memory'.

62. To establish a communication between 8085 microprocessor and 8255 Programmable Peripheral Interface chip the status of the chip select input would be:

(a) TRISTATE (b) HIGH
(c) LOW (d) DON'T CARE

BSNL (JTO)–2006

Ans : (c) To establish a communication between 8085 microprocessor and 8255 programmable peripheral interface chip the status of the chip select input would be LOW.

Programmable Peripheral Interface (PPI)-

PPI 8255 is a general purpose programmable I/O device designed to interface the CPU with its outside word such as ADC, DAC, keyboard etc.

PPI consists of three 8-bit bidirectional I/O parts which is PORT A, PORT B and PORT C.

63. Operating modes of 8255A are:

(a) mode 0- advanced input/output, mode 1- strobed input/output, mode 2- unidirectional data bus
(b) mode 0- basic input/output, mode1- strobed input/output, mode 2- bidirectional data bus
(c) mode 0- control input/output, mode 1- strobed input/output, mode 2- basic data bus
(d) mode 0- basic input/output, mode 1- control input/output, mode 2- strobed data bus

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (b) : The 8255 is a general purpose programmable I/O device that can be used to interface with various peripheral devices. These are three different 8-bit modes are as-

- Mode 0 → Basic input/output
- Mode 1 → Strobed input/output
- Mode 2 → Bidirectional input/output.

64. How many bytes of bit addressable memory is present in 8051 based microcontrollers?

(a) 16 (b) 8
(c) 128 (d) 32

RRB JE- 01.09.2019

Ans. (a) : 16 bytes of bit addressable memory is present in 8051 based microcontrollers.

Some features of 8051 microcontroller-

- Total external data memory-64K
- Total internal data memory -128 bytes
- Total internal code memory-4 KB
- 16 bit timer/counter-2
- No. of interrupts -5

65. Which of the following commands will move the number 65H into the accumulator in 8051 microcontroller?

(a) MOV A, P65 (b) MOV A, #65H
(c) MOV A, 65H (d) MOVA,@65

NPCIL- 2019

Ans. (b) : MOV A, #65H commands will move the number 65H into the accumulator in 8051 microcontroller.

66. Which of the following is an input operational mode of an 8279 keyboard/Display Controller?

(a) Display Scan (b) Display Entry
(c) Master Mode (d) Strobed input

NPCIL- 2019

Ans. (d) : Strobed input is an input operational mode of an 8279 keyboard/Display Controller.

8279 keyboard/ Display Controller- The Intel 8279 is a keyboard/display controller that interfaces a keyboard and display devices with the microprocessor based system.

The keyboard first scans the keyboard and identifies if any key has been pressed then it sends their relative response of the pressed key to the CPU and vice-versa.

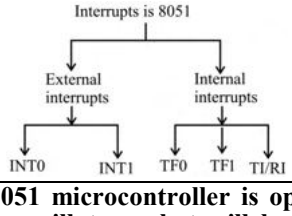
67. Which of the following is the external hardware interrupt source in a 8051 microcontroller?

(a) TF0 (b) TF1
(c) INT0 (d) RI/TI

(14) NPCIL- 2019

Ans. (c) : INT0 is the external hardware interrupt source in a 8051 microcontroller.

8051 microcontroller has total 5 types of interrupts in which two external and three internal interrupts.



68. If the 8051 microcontroller is operated with a 12-MHz oscillator, what will be the execution time for the instruction MUL AB?

(a) 1 μs (b) 2 μs
(c) 3 μs (d) 4 μs

NPCIL- 2019

Ans. (d) : Given that,

f = 12 MHz

Execution time (T)= ?

We know that instruction cycle for MUL AB (n) = 4

Then,

$$T = 12n \times \frac{1}{f} = 12 \times 4 \times \frac{1}{12 \times 10^6}$$

$$T = 4\,\mu s$$

69. How many flags are there in PSW of 8051

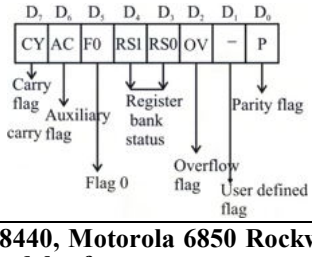
(a) 4 (b) 5

(c) 7 (d) 6

Andhra Pradesh Telecom Circle- 2012

Ans. (d) : There are 6 flags in PSW of 8051 microcontroller.

PSW(Program Status Word)- The flag register in the 8051 is called the program status word. PSW is an 8-bit register.



70. Z8440, Motorola 6850 Rockwell 65C52 etc. are models of

(a) UART

(b) OFC sources

(c) Types of waveguides

(d) OFC detectors

Calcutta Telephones- 2010

Ans. (a) : Z8440, Motorola 6850 Rockwell 65C52 etc are models of UART.

UART (Universal Asynchronous Receiver Transmitter)- It is one of the most generally used serial communication techniques. UART being used in several applications like GPS, receivers, bluetooth modules and wireless communication system.

71. In micro-controller 89S51,'S' stands for:

(a) Special features

(b) Serial programming

(c) Serial interface

(d) Single bit operations

SAIL (IN)-2020

Ans. (b) : In microcontroller 89S51, 'S' stands for serial programming.

89S51 Microcontroller- It is a low power high performance CMOS 8-bit microcontroller with 4K bytes. 89S51 is a powerful microcontroller which provides a highly flexible and cost effective solution to many embedded control applications.

72. How many pins does the 4049 IC have?

(a) 14 (b) 16

(c) 18 (d) 20

Haryana Telecom Circle-2012

Ans. (b) : 4049IC have 16 pins.

4049IC - It consists of six NOT gates inside it and has a high input supply voltage with a maximum current rating of 1mA at 18V.

4049 IC is capable to drive two TTL loads.

- Pin 1 is for supply voltage.
- Pin 3 is for input.
- Pin 2 is for output.
- Pin 5 is for input
- Pin 4 is for output.
- Pin 8 is connected to ground.
- Pin 13 and 16 are unused.

Applications of 4049 IC-

- Voltage multiplier circuit.
- High to low logic converter.
- CMOS hex buffer.
- CMOS to TTL/DTL Hex converter.

73. UART and USART are _____

(a) Serial data controllers
(b) Parallel data controllers
(c) Types of waveguides
(d) None of these

Calcutta Telecom Circle-2012

Ans. (a) : UART and USART are serial data controller.

UART - Universal Asynchronous Receiver Transmitter

USART-Universal Synchronous/Asynchronous Receiver Transmitter.

UART	USART
• It uses full duplex mode	• It uses half duplex mode
• Its speed is less	• Its speed is more than UART
• It entails data signals only for its functioning	• It entails both data signals and clock for its functioning.
• Its data can be transmitted at a definite rate	• Its data can be transmitted at a variable speed.

74. The letter 'A' is USART stands for

(a) Active (b) Analog
(c) Asynchronous (d) Asymmetric

Calcutta Telecom Circle-2012

Ans. (c) : The letter 'A' in USART stands for Asynchronous.

USART→ Universal Synchronous /Asynchronous Receiver Transmitter.

75. Input/output signals of PLC (Programmable Logic Controller) falls under range of PLC

(a) 0-100 mA (b) 0-20 mA
(c) 4-100 mA (d) 4-20 mA

Cochin Shipyard-2021

Ans. (d) : Input/Output signals of PLC (Programmable Logic Controller) falls under range of 4-20mA.

Programmable Logic Controller(PLC)- It is such a physical device which controls industrial operation automatically with the help of logic program i.e. a PLC is a digitalized computer which can be programmed or reprogrammed by programmer.

76. PLA stands for:

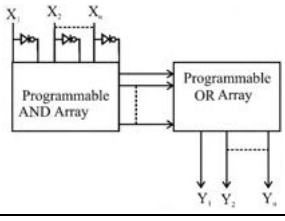
(a) Partial Logic Array
(b) Predictable Logical Array
(c) Parabolic Logic Array
(d) Programmable Logic Array

DFCCIL S&T 17.04.2016, Shift-II

Ans. (d) : PLA stands for Programmable Logic Array.

- PLA has a programmable AND gate array and programmable OR gate array.
- PLA is a combination of memory and logic.

- PLA is used as a counter.
- PLA is used to provide control over datapath.
- PLA is used as a BUS interface in programmed I/O.



77. Which register can be used as memory pointers in 8051

(a) RO (b) RI
(c) DPTR (d) All of the above

Madhya Pradesh Telecom Circle-2012

Ans. (c) : DPTR register can be used as memory pointers in 8051.

DPTR- It stands for 'Data Pointer Register'. It is the only user accessible 16 bit register. It is used to point the data through which operator can access external memory in 8051 microcontroller.

78. Which of the following is a solid state laser?

(a) Nd : YAG laser
(b) Helium-Neon laser
(c) CO_2 laser
(d) Argon-Ion laser

Chennai Telephone- 2010

Ans. (a) : Nd: YAG laser is a solid state laser.

Neodymium: YAG laser- This laser has very high radiant power output at 1064nm.

Yttrium Aluminium Garnet (YAG) $Y_3A\ell_5O_{12}$ is best choise of a host for neodymium ions (Nd)

- YAG offers low threshold and high gain.
- YAG is a very hard, isotropic crystal.
- It has good thermal and mechanical properties.

79. A USART chip provides

(a) Half duplex operation
(b) Full duplex operation
(c) Multiplex operation
(d) Simplex operation

BSNL TTA (JE) 2015
West Bengal Telecom circle-2008

Ans. : (a) USART stands for Universal Synchronous/ Asynchronous Receiver/Transmitter.

- USART chip provide half-duplex mode.
- It uses data signals as well as clock to work.
- It's speed is high.
- The data is transmitted at a definite rate.

80. PID controller uses_____ Between input and output:

(a) Proportional Relation (b) Integral Relation
(c) Differential Relation (d) All of these

BSNL TTA (JE) 27.09.2016, 10 AM

Ans. (d) PID controller uses between input and output for-

- Proportional relation.
- Integral Relation.
- Differential Relation.

PID- It stands for Proportional Integral Derivative. A PID is essentially comparator which is used as control mechanism for various system.

81. The Programmable interrupt controller is required to:

(a) handle one interrupt request
(b) handle one or more interrupt request at a time
(c) handle one more interrupt requests with a delay
(d) handle no interrupt request

BSNL TTA (JE) 27.09.2016, 10 AM

Ans. (b) The programmable interrupt controller is required to handle one or more interrupt request at a time.
Interrupt is the mechanism by which the processor is made to transfer control from its current program execution to another program having higher priority.

82. Which of the following is a DMA controller?

(a) Intel 8257 (b) Intel 8259
(c) Intel 8255 (d) Intel 8253

BSNL TTA (JE) 27.09.2016, 10 AM

Ans. (a) Intel 8257 is a DMA (Direct Memory Access) controller.

- In 8257 DMA controller, the highest priority channel is acknowledged.
- It contains two 16-bit registers, one is DMA address Register and the other one is terminal count register.

83. An 8 bit microcontroller has an external RAM with the memory map from 8000 H to 9FFF H. How many number of bytes can this RAM store?

(a) 1999 (b) 8192
(c) 8191 (d) 8000

ISRO: VSSC TA (EC) 25.02.2018

Ans : (b) $\because$ 8 bit microcontroller size getting 8000H to 9FFFH.

$\therefore$ Increased RAM size−

$(9FFFH - 8000\ H) + 1$
$= 2000H$

$\therefore \quad (2000)_H = (8192)_{10}$

84. In 8051 microcontroller :

(a) 128 byte RAM is available but ROM is not available
(b) 128 byte ROM is available but RAM is not available
(c) RAM and ROM both available
(d) 2 Kbyte RAM is available and ROM is not available

UPPCL JE Trainee Electronics–2015

Ans : (c) In 8051 microcontroller RAM and ROM both available.

- 8051 microcontrollers has internal RAM of 128 bytes and ROM of 4 KB.
- RAM memory is also known as data memory and ROM memory is also known as code memory
- It has a 16-bit program counter and data pointer.
- It has two external and three internal interrupts.
- 8-bit bidirectional data bus.
- 16-bit unidirectional address bus.
- Two 16-bit timers/counters.