



POSTAL BOOK PACKAGE 2027

MECHANICAL ENGINEERING

OBJECTIVE PRACTICE SETS VOLUME - V

ESE SPECIFIC SUBJECTS

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RENEWABLE SOURCE OF ENERGY

OBJECTIVE PRACTICE SETS

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Solar Radiation

- Q.1** Estimate the surface temperature of the sun if extraterrestrial radiation flux received are 1367 W/m^2 . The mean distance between the Sun and Earth is $1.496 \times 10^8 \text{ km}$ and radius of sun is $6.95 \times 10^5 \text{ km}$. You can assume Sun as blackbody.
- (a) 5780 K (b) 5880 K
(c) 4088 K (d) 6180 K
- Q.2** A scientist is carrying out experiments on solar plate collectors in an observatory located at 78°N , 38°E . Due to malfunction of instruments, experimental results are not available. Find out theoretical value of extraterrestrial radiation on 21st June for the given location.
- (a) 1367 W/m^2 (b) 1441 W/m^2
(c) 1353 W/m^2 (d) 1323 W/m^2
- Q.3** What is the orientation angle of Earth and solar flux received outside the atmosphere of Earth on 14th November, 2016?
- (a) 16.47° , 1398 W/m^2
(b) -19.15° , 1116 W/m^2
(c) 16.47° , 1116 W/m^2
(d) -19.15° , 1398 W/m^2
- Q.4** The hour angle made by Earth at a location in New Delhi ($25^\circ 35'\text{N}$, $77^\circ 12'\text{E}$) at 1200 h (LAT) will be _____.
- (a) -7.5° (b) 7.5°
(c) 15° (d) zero
- Q.5** The atmosphere of earth is
- (a) opaque for short-wavelength but transparent for long-wavelength radiation.
(b) transparent for short-wavelength radiation but opaque for long-wavelength radiation.
(c) transparent for both short and long-wavelength radiation.
(d) opaque for both short and long-wavelength radiation.
- Q.6** In solar radiation, the term 'albedo' is used to quantify:
- (a) amount of radiation reflected back to the space
(b) amount of diffuse radiation received on the surface of earth
(c) amount of air-mass ratio for maximum radiation
(d) amount of global radiation received on earth
- Q.7** Find out hour angle at a location in Shillong ($25^\circ 34'\text{N}$, $91^\circ 56'\text{E}$) on 23rd May 2006 at 1000 h (IST). Standard time in India is based on 82.5°E .
- (a) -30° (b) -22.5°
(c) -20.5° (d) -15°
- Q.8** Find out local apparent time in Jodhpur ($26^\circ 18'\text{N}$, $73^\circ 01'\text{E}$)
- (a) 1008 h (b) 0.852 h
(c) 0930 h (d) 0.922 h
- Q.9** A flat plate collector is located in New Delhi ($28^\circ 35'\text{N}$, $77^\circ 12'\text{E}$) and tilted at an angle 36° with horizontal. The collector is facing due south. Find out air-mass ratio on 30th June at 0945 (LAT).
- (a) 1.24 (b) 1.70
(c) 1.16 (d) 1.96
- Q.10** The term 'turbidity' indicates:
- (a) Turbulence intensity in the atmosphere
(b) Haziness caused by invisible particles
(c) Turbulence in the core region of sun
(d) Air velocity in the upper atmosphere
- Q.11** Solar beam radiation falling on a particular in Bulgaria are $800 \text{ W/m}^2\text{-hr}$. If diffused radiation are 10% of the beam radiation, what would be global radiation?
- (a) $720 \text{ W/m}^2\text{-hr}$ (b) $65 \text{ W/m}^2\text{-hr}$
(c) $880 \text{ W/m}^2\text{-hr}$ (d) $100 \text{ W/m}^2\text{-hr}$
- Q.12** Solar constant is obtained from spectral distribution of extraterrestrial radiation. It is the value corresponding to:
- (a) maximum wavelength in the spectra
(b) minimum wavelength in the spectra
(c) mean wavelength in the spectra
(d) area weighted average over the range of wavelengths in spectra

Q.13 A flat plate collector is used for water heating in Jammu (32.72°N, 74.86°E). The collector is inclined at an angle 20° and facing due South. Find out solar beam incident angle (θ) and solar altitude at 1100 h (local apparent time) on 8th August.

- (a) 15.5°, 21.57° (b) 15.5°, 68.43°
(c) 21.57°, 74.5° (d) 15.5°, 74.5°

Q.14 On a hazy day in Bhopal (23.26°N, 77.41°E) at 1030 h (LAT) air-mass ratio is 1.84. Find out solar azimuth angle on 20th Jan 2008 for the given data.

- (a) 57° (b) 43°
(c) 77° (d) 23°

Q.15 A flat plate collector located in Hyderabad (17.39°N, 78.49°E), is used to supply dry air. Find out sunrise hour angle on 23rd March at 730 h (local apparent time). Also find out maximum sunshine hours for the given details.

- (a) 90°, 12 h (b) 450°, 6h
(c) 45°, 12 h (d) 90°, 6 h

Q.16 A concentrated collector is used to heat up brine. The concentrator is located in Lucknow (26.85°N, 80.95°E) and rotated about horizontal east-west axis. The collector is adjusted once a day to track sun. Find out incidence angle on 2nd Feb at 1030 h (LAT) and slope of the surface for the given day respectively.

- (a) 21.5°, 44° (b) 44°, 21.5°
(c) 27.5°, 36° (d) 36°, 27.5°

Q.17 A solar concentrated collector unit is installed in Bhubaneswar (20.30°N, 85.82°E). Find out angle of incidence and solar azimuth angle on 31st Jan, 1400 h, if it is rotated about east-west for continuous adjustment.

- (a) 28°, 39° (b) 28°, 48°
(c) 39°, 28° (d) 39°, 48°

Q.18 A space rover receives power from solar radiation. Horizontal Flat plate collectors of 8 m² area are used for this purpose. The flaps of collector will be opened after crossing atmospheric boundary layer. Space rover will leave Earth's atmosphere on 1st May. Find out extraterrestrial radiation falling on rover on a particular time when solar azimuth angle is 60° for the data given

- (a) 1367 W (b) 1036 W
(c) 5468 W (d) 5380 W

Q.19 Find out the solar radiation on horizontal surface in the absence of the atmosphere at Gurugram (28.46°N, 77.02°E) on 15th April between 0900 to 1000 h.

- (a) 20.85 MJ/m² (b) 3.73 MJ/m²
(c) 1036 KJ/m² (d) 1202 KJ/m²

Q.20 The monthly average daily extraterrestrial radiation at a location (43°5, 80° ω) is 3.5 MJ/m² on 23rd September. Due to same haziness, the clarity index is 0.74. Find out the monthly average daily global radiation if prediction model of page i.e.

$$\frac{\bar{H}_g}{H_0} = a + b \left(\frac{\bar{S}}{\bar{S}_{\max}} \right)$$

is applicable for estimating solar radiation. The value of regression constants are 0.31 and 0.58 respectively. Also find out declination angle of the Earth if observed sunshine hours for the given location are 9 h.

- (a) 2.59 MJ/m², 11.26°
(b) 4.73 MJ/m², 11.26°
(c) 2.59 MJ/m², 14.26°
(d) 2.59 MJ/m², 1.126°

Q.21 The latitude angle is zero at

- (a) Southern Hemisphere
(b) Northern Hemisphere
(c) Equator
(d) All of the above

Q.22 The extraterrestrial solar intensity flux is dependent on:

- (a) Height from the surface of earth
(b) Atmospheric conditions
(c) Locations of the observer
(d) Day of the year

Q.23 Which of the following angle varies seasonally due to the tilt of the earth on its axis and rotations of the earth around the sun?

- (a) Tilt angle (b) Altitude angle
(c) Hour angle (d) Declination angle

Q.24 Which of the following statements is correct in regard of solar Zenith angle?

- (a) It is zero at the time of sunrise

- (b) It is zero at the solar noon
(c) It is zero at the time of sun fall
(d) It is maximum at solar noon

Q.25 Which of the following instruments is used to measure direct/beam radiation?

- (a) Pyrheliometer
(b) Pyranometer
(c) Anemometer
(d) Albedometer

Q.26 The purpose of shading ring which is being used in pyranometer is/are

- (a) to avoid overheating of the sensor.

- (b) to measure diffuse radiation.
(c) to measure day length i.e. sunfall-sunrise hours.
(d) to measure direct radiation.

Q.27 Solar flux are reported in 'Langley' sometimes, which is the unit of radiation adopted after the name of Samuel Langley. 1 Langley is equal to _____.

- (a) 1 cal (b) 1 kcal
(c) 1 cal/cm² (d) 1kcal/cm²



Answers Solar Radiation

1. (a) 2. (d) 3. (d) 4. (d) 5. (b) 6. (a) 7. (c) 8. (d) 9. (c)
10. (b) 11. (c) 12. (d) 13. (b) 14. (b) 15. (a) 16. (b) 17. (b) 18. (d)
19. (b) 20. (d) 21. (c) 22. (d) 23. (d) 24. (b) 25. (a) 26. (b) 27. (c)

Explanations Solar Radiation

1. (a)

The total emitted radiation by the surface of the Sun will be given by:

$$\sigma T_s^4 (4\pi R_s^2)$$

These radiation are received by a sphere having radius equal to mean distance between the Sun and the Earth.

i.e. $I_{sc} \times (4\pi R_m^2)$

Hence $\sigma T_s^4 (4\pi R_s^2) = I_{sc} \times (4\pi R_m^2)$

$$\Rightarrow \sigma T_s^4 = 1367 \times \left(\frac{1.496 \times 10^{11}}{6.95 \times 10^8} \right)^2$$

$$\Rightarrow \begin{aligned} T_s &= (11.17 \times 10^{14})^{1/4} \\ T_s &= 5781.22 \text{ K} \end{aligned}$$

2. (d)

Extraterrestrial solar flux (I'_{sc}) is given by:

$$I'_{sc} = I_{sc} \left[1 + 0.033 \cos \frac{360n}{365} \right]$$

Solar constant,

$$I_{sc} = 1367 \text{ W/m}^2$$

For 21st June, $n = 31 + 28 + 31 + 30 + 31 + 21$
 $= 172$

$$\begin{aligned} \therefore I'_{sc} &= 1367 \left[1 + 0.33 \cos \frac{360 \times 172}{365} \right] \\ &= 1322.62 \text{ W/m}^2 \end{aligned}$$

Note: Location data and 21st June is given to create confusion. On 21st Jun, Earth's declination angle will be 23.45° i.e. default value. One should not select default value of I_{sc} i.e. 1367 W/m² for the given data.

3. (d)

The variation of Earth's orientation angle is given by cooper's relation:

$$\delta = 23.45 \sin \left[\frac{360}{365} (284 + n) \right]$$

On 14th November

$$\begin{aligned} n &= 31 + 29 + 31 + 30 + 31 + 30 \\ &\quad + 31 + 31 + 30 + 31 + 14 = 319 \end{aligned}$$

$$\delta = 23.45^\circ \sin \left[\frac{360}{365} (284 + 319) \right]$$

$$= -19.15^\circ$$

Flux received outside of the atmosphere of Earth i.e. extraterrestrial flux (I'_{sc}) is given by:

$$\begin{aligned} I'_{sc} &= I_{sc} \left[1 + 0.033 \cos \frac{360n}{365} \right] \\ &= 1367 \left[1 + 0.033 \cos \frac{360 \times 319}{365} \right] \\ &= 1396.645 \text{ W/m}^2 \\ &= 1398.69 \text{ W/m}^2 \end{aligned}$$

4. (d)

$$\begin{aligned} \text{Hour angle } (\omega) &= 15 (\text{LAT} - 1200) \\ &= 15 (1200 - 1200) = 0 \end{aligned}$$

5. (b)

Solar radiation are short wavelength ($0.25 \mu_m$ to $3.0 \mu_m$). Earth's atmosphere allow to pass short wavelength radiation, that is why we receive radiation of sun at the surface of the earth.

Earth's surface get heated by solar radiation and emits radiation. These radiation are long-wavelength radiation. Earth's atmosphere is opaque to these radiation and as a result temperature of most of the location on earth is supporting life.

7. (c)

$$\begin{aligned} \text{Hour angle } (\omega) &= 15 (t_{\text{zone}} - 1200) + \omega_{\text{eq.}} \\ &\quad + (\psi - \psi_{\text{zone}}) \\ t_{\text{zone}} &= 1000 \text{ h}; \quad \psi = 91.93^\circ \\ \psi_{\text{zone}} &= 82.5^\circ \end{aligned}$$

The correction equation $\omega_{\text{eq.}}$ can be find out by:

$$\begin{aligned} \omega_{\text{eq.}} &= 229.18 [0.000075 + 0.001868 \\ &\quad \cos B - 0.032077 \sin B \\ &\quad - 0.014615 \cos 2 B - 0.04089 \\ &\quad \sin 2 B] \end{aligned}$$

$$B = \frac{(n-1)360}{365}$$

For 23rd May $n = 31 + 28 + 31 + 30 + 23 = 143$

$$\therefore B = 140.05$$

Substituting value of B into equation (1)

$$\begin{aligned} \omega_{\text{eq.}} &= [0.000075 + 0.001868 \cos \\ &\quad 140.05 - 0.032077 \sin 140.05 \\ &\quad - 0.014615 \cos 280.1 \\ &\quad - 0.04089 \sin 280.1] = 3.61 \text{ min.} \end{aligned}$$

$$\begin{aligned} \therefore \omega &= 15 (1000 - 1200) + \frac{3.61}{60} + (91.93 - 82.5) \\ &= -20.51^\circ \end{aligned}$$

Note: $\omega_{\text{eq.}}$ is negligible and hence it can be omitted from almost all the calculation.

8. (d)

$$\text{LAT} = \text{Standard Time} \pm 4 (\psi_{\text{standard}} - \psi_{\text{zone}}) + \omega_{\text{eq.}} \dots (1)$$

India is in eastern hemisphere and hence negative sign is applicable in equation (1)

Also $\omega_{\text{eq.}}$ is contributing insignificantly and hence can be neglected.

$$\begin{aligned} \therefore \text{LAT} &= 0930 - 4(82.5^\circ - 73.02^\circ) \\ &= 0930 - 37.92 = 0852 \text{ h} \end{aligned}$$

9. (c)

$$\text{Air-mass ratio} = \frac{1}{\cos \theta_z}$$

For given data

$$\cos \theta_z = \sin \delta \cdot \sin \phi + \cos \delta \cdot \cos \phi \cdot \cos \omega$$

$$\text{Now } \delta = 23.45 \sin \left[\frac{360}{365} (284 + n) \right]$$

$$n = 31 + 28 + 31 + 30 + 31 + 30 = 181$$

$$\therefore \delta = 23.45 \sin \left[\frac{360}{365} 465 \right] = 23.18^\circ$$

$$\phi = 28^\circ 35' = 28 \cdot \frac{35}{60} = 28.58^\circ$$

$$\omega = 15(0945 - 1200) = -33.75$$

$$\begin{aligned} \therefore \cos \theta_z &= \sin 23.18^\circ \cdot \sin 28.58^\circ + \cos 23.18^\circ \\ &\quad \cdot \cos 28.58^\circ \cdot \cos (-33.75^\circ) \\ &= 0.8595 \end{aligned}$$

$$\text{AM} = \frac{1}{\cos \theta_z} = \frac{1}{0.8595} = 1.16$$

11. (c)

$$I_b = 800 \text{ W/m}^2\text{-hr}$$

$$I_d = 80 \text{ W/m}^2\text{-hr}$$

$$I_g = I_b + I_d = 880 \text{ W/m}^2\text{-hr}$$

13. (b)

Earth declination angle (δ)

$$= 23.45 \sin \left[\frac{360}{365} (284 + n) \right]$$

on 8th August

$$\begin{aligned} n &= 31 + 28 + 31 + 30 + 31 + 30 \\ &\quad + 31 + 8 = 220 \end{aligned}$$

$$\begin{aligned} \therefore \delta &= 23.45 \sin \left[\frac{360}{365} (284 + 220) \right] \\ &= 15.96^\circ \end{aligned}$$

$$\text{Hour angle } (\omega) = 15(1100 - 1200) = -15^\circ$$

Latitude angle (ϕ) = 32.72°

Inclination/Tilt angle (β) = 20°

For collector facing south

$$\cos \theta_z = \sin \phi \cdot \sin \delta + \cos \phi \cdot \cos \delta \cdot \cos \omega$$

$$\text{and } \cos \theta = \sin(\phi - \beta) \cdot \sin \delta + \cos(\phi - \beta) \cos \delta \cdot \cos \omega$$

$$\Rightarrow \cos \theta = \sin 10.72^\circ \cdot \sin 15.96^\circ + \cos 10.72^\circ \cdot \cos 15.96^\circ \cdot \cos(-15^\circ) = 0.9636$$

$$\Rightarrow \theta = \cos^{-1}(0.9636) = 15.5^\circ$$

$$\cos \theta_z = \sin 32.72^\circ \sin 15.96^\circ + \cos 32.72^\circ \cos 15.96^\circ \cdot \cos(-15) = 0.93$$

$$\theta_z = 21.57^\circ$$

$$\text{Solar Altitude } (\alpha_a) = 90^\circ - \theta_z = 90^\circ - 21.51^\circ = 68.43^\circ$$

14. (b)

Solar azimuth angle (r_s) is given by relations

$$\cos r_s = \frac{\cos \theta_z \sin \phi - \sin \delta}{\sin \theta_z \cos \phi} \quad \dots(1)$$

$$\text{We know } AM = \frac{1}{\cos \theta_z} = 1.24 \Rightarrow \theta_z = \cos^{-1}\left(\frac{1}{1.84}\right)$$

$$\text{Zenith angle } (\theta_z) = 57.08^\circ$$

$$\text{Latitude } (\phi) = 23.26^\circ$$

Declination angle (δ)

$$\delta = 23.45 \sin \left[(284 + n) + \frac{360}{365} \right]$$

$$n = 20$$

$$\therefore \delta = -20.34^\circ$$

Substituting these values into eq. (1)

$$\cos r_s = \frac{\cos 57.08^\circ \cdot \sin 23.26^\circ - \sin(-20.34^\circ)}{\sin 57.08^\circ \cos 23.26^\circ} = 0.729$$

$$r_s = \cos^{-1}(0.729) = 43.2^\circ$$

15. (a)

Sunrise hour angle (ω_s) can be find out using following relation

$$\omega_s = \cos^{-1}[-\tan \phi \cdot \tan \delta]$$

$$\text{Here } \phi = 17.39^\circ$$

$$\text{and } \delta = 23.45 \sin \left[\frac{360}{365} (284 + n) \right]$$

$$n = 31 + 28 + 23 = 82$$

$$\therefore \delta = 23.45 \sin \left[\frac{360}{365} (284 + 82) \right]$$

$$= 0.4036$$

$$\text{Now } \omega_s = \cos^{-1}[-\tan 17.39^\circ \cdot \tan 0.4036^\circ] = 90.126^\circ$$

Maximum number of sunshine hours (s_{\max}):

$$(s_{\max}) = \frac{2}{15} \cos^{-1}(-\tan \phi \cdot \tan \delta)$$

$$= \frac{2}{15} \times 90.126 = 12.02 \text{ h}$$

16. (b)

For concentrated collector in horizontal plane about east-west axis incidence angle is given by:

$$\cos \theta = \sin^2 \delta + \cos^2 \delta \cos \omega$$

For the given data

$$n = 31 + 2 = 33$$

$$\text{Declination angle } (\delta) = 23.45 \sin \left[(284 + 33) \frac{360}{365} \right] = -17.25^\circ$$

$$\text{Hour angle } (\omega) = 15 (1030 - 1200) = -22.5^\circ$$

$$\therefore \cos \theta = \sin^2(-17.25^\circ) + \cos^2(-17.25^\circ) \cos(-22.5^\circ) = 0.9306$$

$$\theta = 21.476^\circ$$

Slope of the concentrator for the given day:

$$\beta = |\phi - \delta| = |26.85^\circ - (-17.25^\circ)| = 44.1^\circ$$

17. (b)

Earth's declination angle

$$\delta = 23.45 \sin \left[\frac{360}{365} (284 + 31) \right]$$

$$= -17.78^\circ$$

$$\text{Hour angle } (\omega) = 15 (1400 - 1200) = 30^\circ$$

$$\text{Latitude } (\phi) = 20.30^\circ \text{ N}$$

Inclination angle for the given collector is given by:

$$\cos^2 \theta = 1 - \cos^2 \delta \sin^2 \omega$$

$$= 1 - \cos^2(-17.78^\circ) \sin^2 30 = 0.7733$$

$$\Rightarrow \theta = 28.43^\circ$$

Solar azimuth angle is given by:

$$\cos \theta_z = \sin \phi \sin \delta + \cos \phi \cdot \cos \delta + \cos \omega$$

$$\cos \theta_z = \sin(20.30^\circ) \cdot \sin(-17.78^\circ) + \cos(20.30^\circ) \cos(-17.78^\circ) \cdot \cos(30^\circ) = 0.6675$$

$$\Rightarrow \theta_z = \cos^{-1}(0.6675) = 48.13^\circ$$

ROBOTICS AND MECHATRONICS

OBJECTIVE PRACTICE SETS

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Microprocessor, Microcontroller, PLC

- Q.1** Consider the following statements comparing static RAM with dynamic RAM:
1. In static RAM typical cell requires more number of transistors than dynamic RAM.
 2. Power consumption per bit of static RAM is less than that of dynamic RAM.
- Which statements is/are correct?
- (a) 1 and 2 only (b) 1 only
(c) 2 only (d) None of these
- Q.2** In microprocessor, the register which holds address of the next instruction to be fetched is
- (a) accumulator (b) program counter
(c) stack pointer (d) instruction register
- Q.3** Which of the following statements are correct?
1. DRAM offers reduced power consumption.
 2. An associative memory is cheaper than RAM.
- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these
- Q.4** The program counter (PC) in a microprocessor
- (a) counts the number of program being executed by the microprocessor.
(b) counts the number of instruction being executed by the microprocessor.
(c) count the number of interrupts handled by the microprocessor.
(d) keeps the address of the next instruction to be fetched.
- Q.5** A memory system has a total of 8 memory chips each with 12 address lines and 4 data lines. The size of memory system is
- (a) 16 kB (b) 32 kB
(c) 48 kB (d) 64 kB
- Q.6** Which statements is/are correct?
1. A processor can reference a memory stack without specifying an address.
 2. The address is always available and automatically updated in the stack pointer.
- (a) 1 only
(b) 2 only
(c) Both 1 and 2 and 2 explains 1
(d) Both 1 and 2 but 2 does not explain 1
- Q.7** 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
- (a) Carry status flag
(b) Auxiliary carry status flag
(c) Sign status flag
(d) Zero status flag
- Q.8** The address bus of Intel 8085 is 16 bit and hence the memory which can be accessed by this address bus is
- (a) 1 kB (b) 16 kB
(c) 32 kB (d) 64 kB
- Q.9** A microprocessor based system can perform many different function because
- (a) Its operation is controlled by software
(b) It is digital system
(c) It uses a RAM
(d) It can be controlled by input and output device
- Q.10** Which of the following are included in architecture of a computer?
1. Addressing mode, CPU
 2. Instruction mode, data formats
 3. Secondary memory, operating system.
- Select the correct answer using the codes below:
- (a) 1 and 2 (b) 3 and 1
(c) 2 and 3 (d) 3 only
- Q.11** Which of the following is/are correct statements?
1. Bus is a group of wires carrying information.
 2. Bus is needed to achieve reasonable speed of operation.
 3. Bus can carry data or address.
 4. A bus can be shared by more than one device.

Select the correct answer using the codes below:

- (a) 1 only (b) 1 and 2 only
(c) 2, 3 and 4 only (d) 1, 2, 3 and 4

Q.12 A micro program

- (a) is usually written in high level language.
(b) is a program for micro computer.
(c) is a program written in assembly language.
(d) is a sequencing program for the control unit of any processor.

Q.13 The following register holds the instruction before it goes to decoder

- (a) Control register (b) Accumulator
(c) Address register (d) Data register

Q.14 ROM is used to store table for multiplication of two 8-bit unsigned integer. The size of the ROM required is

- (a) $256k \times 8$ (b) $64k \times 8$
(c) $4k \times 16$ (d) $64k \times 16$

Q.15 Ready signal in 8085 is useful when the CPU communicates with

- (a) A slow peripherals devices
(b) A fast peripherals device
(c) A DMA controller chip
(d) A PPI chip

Q.16 Which of the following register of 8085 microprocessor is not a part of programming model?

- (a) Instruction register
(b) Memory address register
(c) Status register
(d) Temporary data register

Q.17 The computer program which converts statement written in high level language to object code is known as

- (a) Assembler (b) Compiler
(c) Disassembler (d) Operating system

Q.18 In an assembler, which of the following is required for variable name in symbol table?

- (a) Address (b) Values
(c) Register (d) Storage

Q.19 Which of the following flags is not used for branching in a microprocessor?

- (a) Carry flag (b) Auxiliary carry flag
(c) Overflow flag (d) Parity flag

Q.20 As compared to 16 bit microprocessor; 8 bit microprocessor are limited in

1. Speed
2. Directly addressable memory
3. Data handling capability

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

Q.21 What is the address space of 8086 CPU?

- (a) One megabyte (b) 256 kilobyte
(c) 1k megabyte (d) 64 kilobytes

Q.22 Which of the following is incorrect for a microprocessor?

1. It has ALU, CU and register.
2. It has interfacing circuits, timers.
3. It has internal memory.

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

Q.23 A processor has 36 address lines. What is the maximum memory that can be connected or interfaced?

- (a) 32 MB (b) 64 MB
(c) 32 GB (d) 64 GB

Q.24 Which is correct for function of register array in microprocessor?

1. They act as small storage device that are available to CPU or processors.
2. They act as temporary storage for processing of intermediate data by mathematical or logical operations.

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these

Q.25 Which are correct for microcontroller?

1. Parts are embedded on single chip.
2. It is small
3. Less access time for built-in memory and I/O device.

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

Q.26 Microcontroller are based on

- (a) Harvard architecture
(b) Von-neumann architecture
(c) any of two Harvard or Von-neumann architecture
(d) None of these

- Q.27** Which of the following is/are correct statements?
1. Microprocessor is based on Von-Neumann architecture.
 2. Microprocessor has less number of register as compared to microcontroller.
 3. Microcontroller is based on Harvard architecture
- (a) 1 only (b) 1 and 2
(c) 2 and 3 (d) 1, 2 and 3
- Q.28** Microcontroller are used in
- (a) automobile engine control system
 - (b) implantable medical devices
 - (c) remote control, office machine, power tools
 - (d) all above are correct
- Q.29** Which of the following statements are correct about programmable logic controller (PLC)?
1. PLC is a specialized computer used to control machines and process.
 2. The PLC uses a programmable memory to store/save instructions and specific functions that include ON/OFF control counting, arithmetic, timing, sequencing and also data handling.
- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these
- Q.30** Which of the following are the advantage of programmable logic controller (PLC)?
1. It is flexible
 2. It has faster response time
 3. It has no moving parts
 4. It is expensive
- (a) 1, 2 and 3 (b) 1, 3 and 4
(c) 2, 3 and 4 (d) 1, 2, 3 and 4
- Q.31** Which of the following bus is uni-directional bus?
1. Address bus
 2. Data bus
 3. Control bus
- (a) 1 and 2 (b) 1 and 3
(c) 1 only (d) 2 only
- Q.32** The lower and higher order address carry address during which state of op-code fetch machine cycle.
- (a) T_1 state (b) T_2 state
(c) T_3 state (d) T_4 state
- Q.33** Which of the following interrupt is a non-maskable interrupt?
- (a) RST 7.5 (b) RST 6.5
(c) RST 5.5 (d) TRAP
- Q.34** Which of the following is 16 bit register?
1. Stack pointer 2. Program counter
 3. Accumulator 4. 'B' register
- (a) 1 and 4 (b) 1 and 3
(c) 2 and 4 (d) 1 and 2
- Q.35** Which of the following register is used as memory pointer of 8086 microprocessor?
- (a) Flag register (b) AH register
(c) Source index register
(d) DH register
- Q.36** Which of the following is not a hardware interrupt?
- (a) RST 6.5 (b) RST 6
(c) RST 5.5 (d) TRAP
- Q.37** Which of the following is/are correct?
1. Linker is a program which breaks down larger program into smaller program and also links main program with subordinate program.
 2. Loader is a program which loads machine code of a program into the system memory.
- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) None of these
- Q.38** Which of the following is correct for compiler?
- (a) Program which translate a high level program into a machine language, read entire program and executes it.
- (b) Program which translates a machine language program into a high level program.
- (c) Program which translates a high level program into a machine language and execute it and read one statement at a time executes and the goes to the next statements of the program.
- (d) None of these
- Q.39** An interpreter is
- (a) Program which convert machine language into high level language.
- (b) Program which convert a high level program into a machine language, reads the entire program and execute it.
- (c) Program which translates a high level program into machine code, executes it and reaches one statement at a time executes and then goes to the next statements of the program.
- (d) None of these

Direction (Q.51 to Q.53): The following questions consist of two statements, one labelled as 'Statement (I)' and the other labelled as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below.

Codes:

- (a) Both Statement (I) and Statement (II) are true and Statement (II) is the correct explanation of Statement (I).
- (b) Both Statement (I) and Statement (II) are true but Statement (II) is not a correct explanation of Statement (I).
- (c) Statement (I) is true but Statement (II) is false.
- (d) Statement (I) is false but Statement (II) is true.

Q.51 Statement (I): The data bus and address bus of 8085 microprocessor are multiplexed.

Statement (II): Multiplexing reduces the number of pins.

Q.52 Statement (I): The function of arithmetic logic unit (ALU) in microprocessor is to perform data manipulation.

Statement (II): The status register is where data for an input to the arithmetic and logic unit is temporarily stored.

Q.53 Statement (I): The count-up overflow (OV) bit is 1 when the up-counter increments above the maximum positive value.

Statement (II): The count-down underflow (UN) bit is 1 when the counter decrements below the minimum negative value.



Answers Microprocessor, Microcontroller, PLC

- | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 1. (a) | 2. (b) | 3. (a) | 4. (d) | 5. (a) | 6. (d) | 7. (c) | 8. (d) | 9. (a) |
| 10. (a) | 11. (d) | 12. (c) | 13. (a) | 14. (d) | 15. (a) | 16. (d) | 17. (b) | 18. (c) |
| 19. (b) | 20. (d) | 21. (a) | 22. (b) | 23. (d) | 24. (c) | 25. (d) | 26. (a) | 27. (d) |
| 28. (d) | 29. (c) | 30. (a) | 31. (c) | 32. (a) | 33. (d) | 34. (d) | 35. (c) | 36. (b) |
| 37. (b) | 38. (a) | 39. (c) | 40. (a) | 41. (a) | 42. (b) | 43. (d) | 44. (d) | 45. (a) |
| 46. (d) | 47. (c) | 48. (d) | 49. (a) | 50. (b) | 51. (a) | 52. (c) | 53. (c) | |

Explanations Microprocessor, Microcontroller, PLC

1. (a)

Static RAM

- Never refreshed
- Fast
- More expensive
- Require 4 or 6 transistor along with some wiring

Dynamic RAM

- Frequent refresh
- Slow
- Less expensive
- Require a transistor and a capacitor

2. (b)

Program counter : In microprocessor program counter (PC) hold address of the next instruction which is to be fetched.

3. (a)

DRAM offers reduced power consumption as the information is stored in capacitor fastest.

Associative memory is more expensive than RAM because each all must have an extra storage capability as well as logic circuits formatting its content with external arrangement.

4. (d)

Program counter (PC) : It is a 16 bit register which is user accessible. It keeps the track of address of the next instruction to be fetched from memory for execution

5. (a)

Number of memory location in each chip = 2^{12}
 Number of bits in each chip = $2^{12} \times 4$ bits
 Total number of bits in memory system

$$\begin{aligned}
 &= 8 \times 4 \times 2^{12} \text{ bits} \\
 &= 4 \times 2^2 \times 2^{10} \text{ bytes} \\
 &= 16\text{k bytes [1 byte = 8 bit]}
 \end{aligned}$$

6. (d)

Stack pointer (SP) always keeps the address of stack-top. Stack pointer keeps updating its value automatically during stack operations.

7. (c)

The flag register have five different flag bit as below:

D ₇	D ₆	D ₅	D ₄	D ₃	D ₂	D ₁	D ₀
S	Z	X	AC	X	P	X	CY

1. Sign flag (s)
2. Zero flag (z)
3. Auxiliary flag (AC)
4. Parity flag (P)
5. Carry flag (C)

8. (d)

Memory accessed by address bus

$$\begin{aligned}
 &= 2^{(\text{number of address lines})} \\
 &= 2^{16} = 2^{10} \times 2^6 = 64\text{k bytes}
 \end{aligned}$$

9. (a)

It can perform many function because its operation is controlled by software and it can be programmed to perform desired tasks.

10. (a)

Secondary memory and operating system are not the part of computer architecture.

12. (c)

Microprogram is written in assembly language by the designer. It consists only of basic elemental Comments which directly control the operation or each functional element in a microprocessor.

13. (a)

Control register: It hold the instruction before it goes to decoder. It is same times also called as instruction register.

Accumulator: It acts as one source of operand to ALU and as destination to result.

Address register: it holds address of some location of memory.

Data register: It hold certain data.

14. (d)

$$\begin{bmatrix} 8\text{-bit} \\ \text{unsigned} \\ \text{number} \end{bmatrix} \times \begin{bmatrix} 8\text{-bit} \\ \text{unsigned} \\ \text{number} \end{bmatrix} = \begin{bmatrix} 16\text{-bit} \\ \text{unsigned} \\ \text{number} \end{bmatrix}$$

To store 16-bit unsigned number \Rightarrow 16 bit.
For 16 bit $\Rightarrow 2^{16}$ number can be possible.
Hence to store 216 number, each of 16-bit we require $2^{16} \times 16$ bit = 64 k \times 16 bit

15. (a)

When a slow peripheral device communicates with CPU, the CPU has to wait for the peripheral device. The peripheral device make the CPU wait by putting 'low' the ready signal.

16. (d)

Temporary data register and W and Z register are not accessible to programmer but 8085 uses them internally to hold temporary data during execution of some instructions.

17. (b)

A compiler is a computer program that translate code written in a high level language to a lower level language i.e., object/machine code.

18. (c)

Register is used to store variable name in symbol table.

19. (b)

We can see that for all other flags jumps instructions are present but not for auxiliary carry flag. Hence it is not used for branching instructions in a microprocessor.

20. (d)

- Directly addressable memory = 2 (number of address bus)
- Data handling capacity increases as size of ALU increase.
- Speed increase as number of data bus increase.

21. (a)

Number of address line of 8086 = 20
Size of memory = 2^{20} = 1 Mbytes

22. (b)

Microprocessor do not have interfacing circuits, timers, and it also do to have internal memory