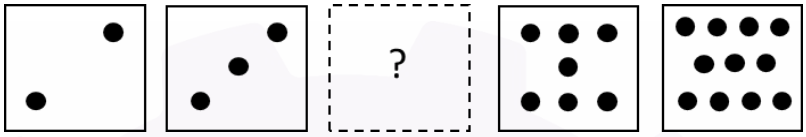
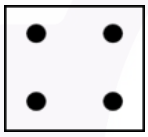
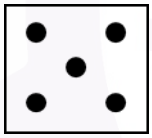
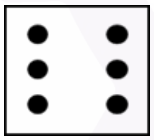
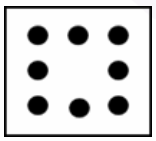
General Aptitude (GA)

Q.1 – Q.5 Carry ONE mark Each

Q.1	"He often _____ the numbers. False claims are not going to help. Honesty _____ trust", said the manager. Choose the option with the correct order of words to fill the blanks.
(A)	exaggerates; engenders
(B)	excels; encourages
(C)	aggravates; alleviates
(D)	diminishes; eliminates

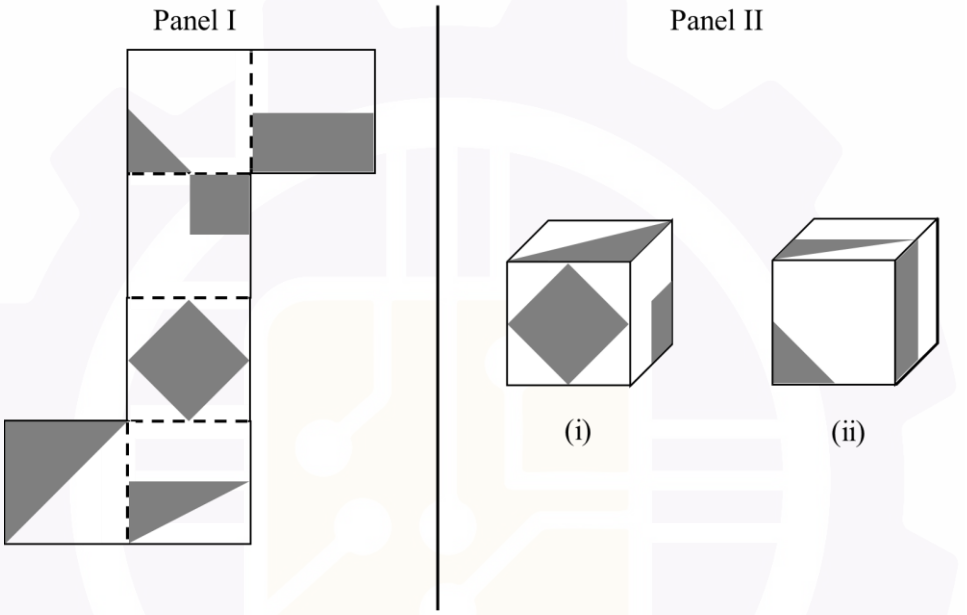
Q.2	In the sequence of tiles shown below, the missing tile indicated by the question mark should be 
(A)	
(B)	
(C)	
(D)	

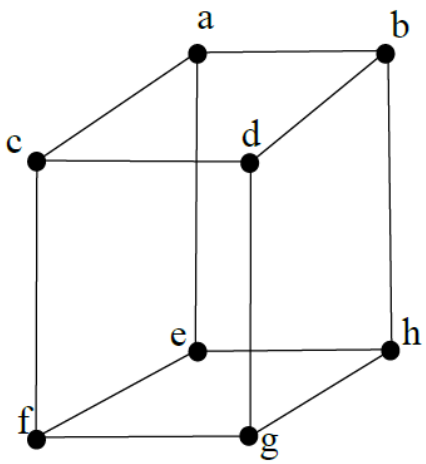
Q.3	A school has 100 students distributed among 1^{st} to 10^{th} standards. Based on this, which one of the following statements is always correct?
(A)	There are at least 10 students who belong to the same standard.
(B)	There is at least one student in each standard.
(C)	There are at most 10 students in 10^{th} standard.
(D)	The total number of students from 1^{st} to 5^{th} standards is at least 50.
Q.4	How many 3-digit numbers can be formed using three distinct single digit prime numbers?
(A)	64
(B)	24
(C)	12
(D)	4

Q.5	In a group of students, 10 students like Mathematics, 12 students like English, 4 students like both Mathematics and English, and 6 students like neither Mathematics nor English. The number of students in the group is ____
(A)	18
(B)	20
(C)	24
(D)	32

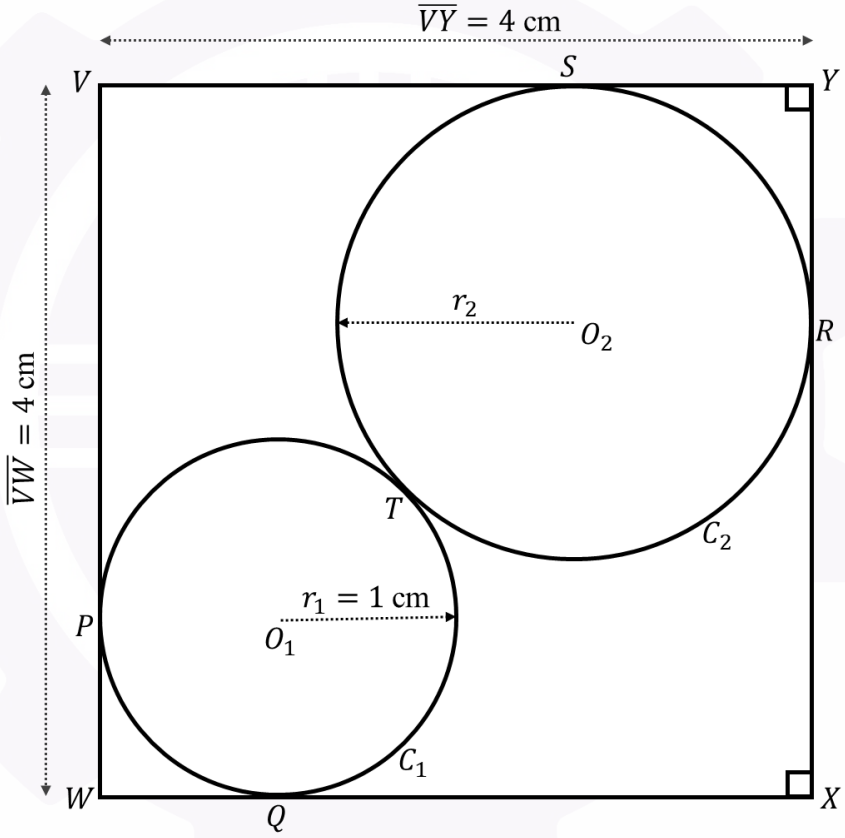
Q.6 – Q.10 Carry TWO marks Each

Q.6	Charity : P :: Retaliation : Q Choose the appropriate pair of words P and Q that fit the analogy.
(A)	P = Parsimonious; Q = Vengeful
(B)	P = Altruistic; Q = Amicable
(C)	P = Resentful; Q = Spiteful
(D)	P = Magnanimous; Q = Vindictive

Q.7	A paper shown in Panel I is folded along the dashed lines (- - -) to construct a cube. The shaded regions shown in Panel I appear on the outer surface of the cube. Referring to cubes shown in Panel II, which one of the options is correct? 
(A)	Only (i) can correspond to the unfolded cube in Panel I.
(B)	Only (ii) can correspond to the unfolded cube in Panel I.
(C)	Both (i) and (ii) can correspond to the unfolded cube in Panel I.
(D)	Neither (i) nor (ii) can correspond to the unfolded cube in Panel I.

Q.8	Consider the cube shown below with its 8 corners labelled a, b, c, d, e, f, g, and h. The figure is representative. All corners are to be colored such that any two corners that are connected by an edge must be of different colors. The minimum number of colors required to achieve this is _____ 
(A)	8
(B)	4
(C)	3
(D)	2

Q.9	Four hills H1, H2, H3, and H4 are present in an area. The following observations are made about them: i. Neither H2 nor H3 is the easternmost hill. ii. Neither H2 nor H3 is the westernmost hill. iii. Neither the easternmost hill nor the westernmost hill is the southernmost hill. iv. Two hills are located to the west of H2. v. The southernmost hill has at least two hills to its east. The southernmost hill is _____.
(A)	H1
(B)	H2
(C)	H3
(D)	H4

Q.10	As shown in the figure, circle C_1 with center O_1 and radius r_1 touches the square $VWXY$ at points P and Q while circle C_2 with center O_2 and radius r_2 touches the square $VWXY$ at points R and S. The two circles touch each other at T. Given $r_1 = 1$ cm and $\overline{VY} = \overline{VW} = 4$ cm, r_2 = _____ cm. 
(A)	$4 - 3\sqrt{2}$
(B)	$1 + 2\sqrt{2}$
(C)	$7 - 4\sqrt{2}$
(D)	$5 + 3\sqrt{2}$

PART A: Common FOR ALL CANDIDATES

Q.11 – Q.27 Carry ONE mark Each

Q.11	Which one of the following options influences the pixel size of an image obtained from a whiskbroom optical remote sensing sensor?
(A)	Sampling interval of the sensor (ΔT)
(B)	Ground Projected Instantaneous Field of View (GIFOV)
(C)	Ground Projected Field of View (GFOV)
(D)	Both ΔT and GIFOV
Q.12	In the following options, the spectral bands of a remote sensing image are mapped to the colours of the display system. Which one of the following combinations indicates a standard False Colour Composite (FCC)?
(A)	Green to Blue; Red to Green; Near Infrared to Red
(B)	Near Infrared to Green; Red to Blue; Green to Red
(C)	Blue to Green; Green to Red; Red to Blue
(D)	Green to Red; Red to Green; Near Infrared to Blue

Q. 13	Which one of the following spectral ranges is the most suitable for distinguishing snow from cloud?
(A)	1.55 μm – 1.75 μm
(B)	0.45 μm – 0.52 μm
(C)	0.52 μm – 0.60 μm
(D)	0.76 μm – 0.85 μm
Q.14	The length of a highway was measured in 10 equal sections. If the precision of the individual section measurements is σ, then what is the precision of the measured length of the highway?
(A)	$\sigma\sqrt{10}$
(B)	$\sigma/\sqrt{10}$
(C)	10σ
(D)	σ/10

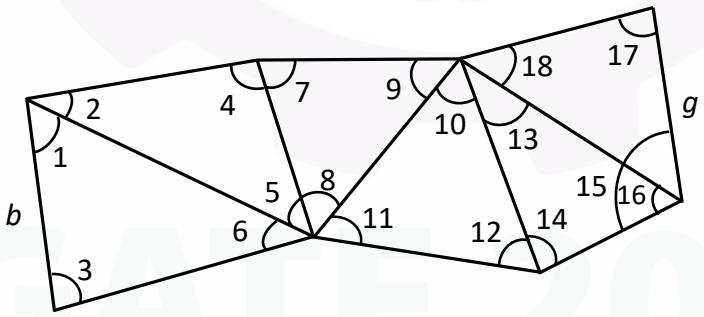
Q.15	In GNSS positioning, the dilution of precision is a good indicator of _____.
(A)	Satellite geometry
(B)	Clock error
(C)	Number of available satellites
(D)	Multipath error
Q.16	The carrier phase observation model in GNSS is given as $$\phi_A^i = f\delta^i - \frac{\rho_A^i}{\lambda} - f\delta_A + N_A^i - f\delta_{\text{iono}} + f\delta_{\text{tropo}} + \epsilon$$ where ϕ_A^i is the observed carrier phase in cycles, f is the frequency of the carrier in hertz, and λ is the wavelength of the carrier in meters. What is the unit of the ionospheric (δ_{iono}) and tropospheric (δ_{tropo}) delay terms in the given equation?
(A)	Second
(B)	Meter
(C)	Cycle
(D)	Cycles/second

Q.17	In GNSS positioning, the cycle slips are the most detrimental for estimating _____.
(A)	Integer ambiguity
(B)	Receiver clock error
(C)	Multipath error
(D)	Atmospheric delay
Q.18	Which one of the coordinate pairs represents the satellite orbit in the skyplot of the GNSS constellations?
(A)	Elevation, Azimuth
(B)	Right ascension, Declination
(C)	Altitude, Declination
(D)	Zenith angle, Azimuth

Q.19	Select the CORRECT option that shows the match between Geometry and Error Type in vector data digitization. **Geometry** (P) Tiny graphic polygons (Q) Open polygons (R) Overshoot/undershoot (S) Polygons with inadmissible loops **Error Type** (1) Sliver polygon (2) Dangle (3) Weird polygon
(A)	P-1; Q-2; R-2; S-3
(B)	P-2; Q-2; R-1; S-3
(C)	P-2; Q-1; R-2; S-3
(D)	P-1; Q-3; R-2; S-2

Q.20	Buffering operation on a point or a line results in a _____.
(A)	Polygon
(B)	Point
(C)	Line
(D)	Polyline
Q.21	Which is/are the CORRECT option(s) that indicate(s) a multispectral sensor?
(A)	A sensor with 10 non-contiguous spectral bands having a bandwidth of about 0.04 µm
(B)	A sensor with 256 contiguous spectral bands with each having a bandwidth of 5 nm
(C)	A sensor with a single spectral band having a bandwidth of 0.4 µm
(D)	A sensor with 1000 contiguous spectral bands with each having a bandwidth of 1 nm

Q.22	Which of the following is/are topological relationship element(s) in GIS?
(A)	Adjacency
(B)	Connectivity
(C)	Containment
(D)	Intersection
Q.23	Which of the following is/are preserved in the Mercator projection?
(A)	Shape
(B)	True direction
(C)	Equal area
(D)	Shape only along the standard parallel

Q.24	Which of the following options is/are CORRECT in the context of line-area spatial relationship?
(A)	Line is contained in area
(B)	Line crosses area
(C)	Line is parallel to area
(D)	Line is nearest to area
Q.25	In the triangulation network shown in the figure, b and g are the observed lengths of the baselines, while 1 to 18 are the observed interior angles. The number of redundant observations is _____ (*Answer in integer*). 
Q.26	Consider a continuous random variable X which follows a normal distribution. A sample of size $n = 25$ is drawn from the distribution of X. Sample mean is 5. Sample standard deviation is 1.5. The probability of $P[X = 5]$ is _____ (*Rounded off to two decimal places*).
Q.27	Consider a random experiment of rolling a fair die. The probability of getting an odd number or a number less than 4 is _____ (*Rounded off to two decimal places*).

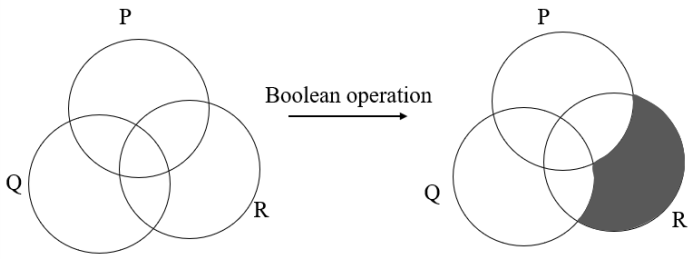
Q.28 – Q.46 Carry TWO marks Each

Q.28	Using the Modified Rayleigh Criteria, for an incidence angle of 20°, select the Root Mean Square (RMS) height (in mm) that appears smooth to an L-band microwave sensor (23.5 cm wavelength) and rough to an X-band microwave sensor (3 cm wavelength).
(A)	8
(B)	11
(C)	1
(D)	3

Q.29	A random variable X has the sample space {0,1}. The probability $P(X = 0) = 1/4$ and $P(X = 1) = 3/4$. What is the variance of the random variable? Hint: $Mean\ (\mu) = \sum_{i=1}^{n} x_i p(x_i)\ ;\ Variance\ (\sigma^2) = \sum_{i=1}^{n} (x_i - \mu)^2 p(x_i)$
(A)	3/16
(B)	3/4
(C)	9/16
(D)	6/16

Q.30	Select the CORRECT option that shows the match between spectral bands and the factors affecting the spectral signature of vegetation at the leaf level. **Spectral bands** — **Factors affecting the spectral signature of vegetation at the leaf level** (P) Green — (i) Water content in the leaf (Q) Red — (ii) Internal structure of the leaf (R) Near Infrared — (iii) Absorption from chlorophyll (S) Shortwave Infrared — (iv) Reflectance from chlorophyll
(A)	(P)-(iv), (Q)-(iii), (R)-(ii) and (S)-(i)
(B)	(P)-(iii), (Q)-(iv), (R)-(ii) and (S)-(i)
(C)	(P)-(iv), (Q)-(iii), (R)-(i) and (S)-(ii)
(D)	(P)-(iii), (Q)-(iv), (R)-(i) and (S)-(ii)

Q.31	In the variance-covariance matrix given below, which one of the following pairs of elements has the highest correlation? $\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array}\begin{array}{c} \begin{array}{cccc} P & Q & R & S \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 3.73 & 1.85 & 3.23 \\ 0 & 1.85 & 0.93 & 1.61 \\ 0 & 3.23 & 1.61 & 2.79 \end{bmatrix} \end{array}$
(A)	Q-S
(B)	Q-R
(C)	R-S
(D)	P-R

Q.32	For three circular regions, labeled as P, Q and R, shown in the figure, select the Boolean operator, which returns the shaded area. 
(A)	NOT (P OR Q)
(B)	NOT (P AND Q)
(C)	NOT (P OR Q OR R)
(D)	NOT ((P OR Q) AND R)

Q.33	In the context of GIS, select the CORRECT option that shows the match between attribute and data scale. **Attribute** / **Data scale** (P) 23 °C / (1) Nominal (Q) Woodland / (2) Interval (R) Kilogram / (3) Ordinal (S) Small / (4) Ratio
(A)	(P)-(2); (Q)-(1); (R)-(4); (S)-(3)
(B)	(P)-(2); (Q)-(1); (R)-(3); (S)-(4)
(C)	(P)-(1); (Q)-(2); (R)-(4); (S)-(3)
(D)	(P)-(1); (Q)-(3); (R)-(2); (S)-(4)

Q.34	Consider 62 pair of observations (x_i, y_i), i = 1, …., 62, obtained from the distribution of (X, Y). The Pearson correlation coefficient (R) of these observations is 0.27. Which one of the following statements is CORRECT for a significance level $\alpha = 0.05$ and $t_{0.025,60} = 2.0$? Hint: Test statistic $t = \frac{R\sqrt{n-2}}{\sqrt{1-R^2}}$
(A)	X and Y are significantly linearly correlated
(B)	X and Y are statistically independent
(C)	X and Y are not significantly linearly correlated
(D)	X and Y are physically related

Q.35

A typical conditional function has the form:

Output = CON (test, out if true, out if false)

What will be the reclassified output if the following conditional reclassification function *Output = CON (Layer P < 3, Layer Q, Layer R)* is applied on the three input raster layers P, Q, and R?

Layer P

1	3	1
0	5	2
4	2	5

Layer Q

x	x	y
x	x	x
x	x	y

Layer R

b	b	b
a	b	b
a	b	b

(A)

x	b	y
x	b	x
a	x	b

(B)

x	b	y
x	x	b
a	x	b

(C)

x	b	y
x	x	x
x	x	y

(D)

x	b	x
x	b	x
a	x	b

Q.36	In general, trilateration is considered to be the principle of GNSS positioning. Which other surveying principle describes GNSS positioning?
(A)	Resection
(B)	Intersection
(C)	Triangulateration
(D)	Reduction
Q.37	Let $X = cos\ \Theta$ and $Y = sin\ \Theta$, where Θ is a random variable uniformly distributed over $(0, 2\pi)$. Which of the following options is/are CORRECT? Hint: $\text{cov}(X, Y) = E\left[\left(X - E(X)\right)\left(Y - E(Y)\right)\right]$
(A)	X and Y are dependent and uncorrelated
(B)	X and Y are independent and uncorrelated
(C)	X and Y are dependent and correlated
(D)	X and Y are independent and correlated

Q.38	In the context of GNSS positioning, which of the following statements is/are INCORRECT?
(A)	Centering and levelling are inconsequential for GNSS positioning as the GNSS antenna can receive signal from any direction
(B)	Carrier phase measurements and code phase measurements can provide comparable positioning accuracy
(C)	The satellite positions of the GNSS satellites are provided in terms of Kepler elements so that the orbit can be propagated in time
(D)	An elevation mask is used in GNSS satellite data acquisition to avoid measurements from low elevation angles as they are affected by high atmospheric refraction and are susceptible to multipath effects
Q.39	In relational database management systems, which of the following objectives is/are achieved after normalization process?
(A)	No redundant data in the table
(B)	A distributed database
(C)	Attribute data in separate tables are maintained and updated separately
(D)	Aggregation of the table

Q.40	Power of a statistical test is the probability of rejecting the null hypothesis when the alternate hypothesis is true. Which of the following statements is/are CORRECT?
(A)	Power is computed as $1-\beta$, where β is the probability of Type II error
(B)	Power is interpreted as the probability of correctly rejecting a false null hypothesis
(C)	Power is computed as $1-\alpha$, where α is the probability of Type I error
(D)	Power is interpreted as the probability of falsely rejecting a correct null hypothesis
Q.41	A trapezoidal land parcel for a residential plot measures 10.335 m in the south, 13.971 m in the north, 5.047 m in the west and 6.302 m in the east directions. The north and south sides are perpendicular to the western side of the plot, making the eastern side skewed. Given the lengths of the sides are measured with a precision of 1 mm, the precision of the area of the plot calculated from these measurements is _____ m^2 (*Rounded off to two decimal values*). Hint: Area of a trapezium $= \left(\frac{sum\ of\ parallel\ sides}{2}\right) \times\ height$
Q.42	The total irradiance on a Lambertian surface is 540 $W\ m^{-2}$. The reflectance of the surface is 20%. The path radiance from the atmosphere towards the sensor is 2.5 $W\ m^{-2}\ sr^{-1}$. The transmissivity of the atmosphere is 80%. The radiance reaching the sensor is _____ $W\ m^{-2}\ sr^{-1}$ (*Rounded off to the nearest integer*).
Q.43	Sunlight travels from medium A (refractive index = 1.5) to medium B (refractive index = 1.033). The angle of incidence beyond which the refracted ray will be in medium A without travelling to medium B is _____ ° (*Answer in decimal degrees and rounded off to two decimal values*).

Q.44	Assuming Sun's temperature to be 5727 °C and Earth's temperature to be 27 °C, the ratio between the total radiant exitance of Sun and that of Earth is _____ (*Rounded off to the nearest integer*).
Q.45	Satellites A and B are in circular orbits at a height of 900 km and 300 km, respectively, above the Earth's surface. The velocity of satellite B will be _____ times the velocity of satellite A (*Rounded off to three decimal places).* Assume radius of Earth to be 6378 km, acceleration due to gravity to be 9.81 m s^{-2}, the product of universal gravitational constant and mass of Earth is 3.98601×10^{14} m^3 s^{-2}. Hint: For a satellite to remain in circular orbit around the Earth, the Earth's gravitational force must be balanced by the centrifugal force of the orbiting satellite.
Q.46	According to the first order ionospheric delay term, the time delay experienced by the GNSS signal is directly proportional to the Total Electron Content (TEC) in the ionosphere, and inversely proportional to the square of the frequency of the carrier wave. Based on this, the GPS L2 (1227.60 MHz) carrier is slower than the GPS L1 (1575.42 MHz) carrier by a factor of _____ for a given TEC (*Rounded off to the nearest integer*).

PART B: FOR Section I: Surveying and Mapping CANDIDATES ONLY

Q.47 – Q.54 Carry ONE mark Each

Q.47	A parallax bar can be used to measure _____ while viewing the two photos stereoscopically.
(A)	parallax
(B)	flying height
(C)	scale of the photo
(D)	focal length of the camera
Q.48	Which one of the following is the purpose of taking a backsight observation in levelling?
(A)	To ascertain the elevation of line of sight
(B)	To find out the collimation error of the instrument
(C)	To find the elevation of the benchmark
(D)	To find the elevation of the point over which the staff is held during the backsight

Q.49	A Digital Elevation Model (DEM) with a vertical Root Mean Square Error (RMSE) of 2 m means that _____.
(A)	the average magnitude of vertical error in the DEM is 2 m
(B)	the DEM has a horizontal accuracy of ±2 m
(C)	the slope values more than 2° cannot be derived from the DEM
(D)	only low relief can be analyzed using the DEM
Q.50	For a proper stereoscopic viewing, the stereopair should be oriented in such a way that the flight line of each photo lies _____.
(A)	along a common straight line
(B)	on two mutually perpendicular planes
(C)	on two parallel straight lines with a horizontal gap equal to half of the size of the photo
(D)	on two mutually perpendicular lines

Q.51	Which one of the following is NOT a geometric method of map projection?
(A)	Polyconic
(B)	Gnomonic
(C)	Stereographic
(D)	Orthographic
Q.52	Which one of the following is NOT a geodetic reference frame?
(A)	EGM96
(B)	WGS84
(C)	ITRF14
(D)	NAD83
Q.53	The forebearing of four sides of a closed quadrilateral ABCDA are AB = 60°, BC = 149.87°, CD = 269.5°, DA = 20.17°. The calculated value of interior angle D is _____° (*Answer in decimal degrees and rounded off to two decimal values).*

Q.54	The flying height of an aircraft above the base of a building is 500 m. In the nominally vertical aerial photograph, the radial distance from the principal point to the top of the building is 90 mm. The photo size is 230 mm × 230 mm. The relief displacement of the building is 6 mm. The estimated height of the building is _____ m (*Rounded off to the nearest integer*).

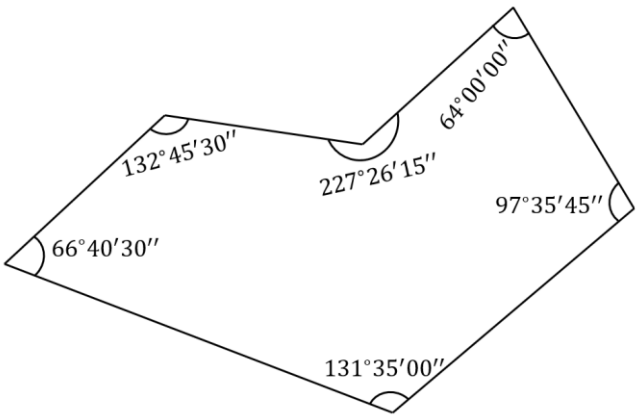
Q.55 – Q.65 Carry TWO marks Each

Q.55	For a camera with focal length 150 mm and a 30 cm × 30 cm format size, what height above ground (in meters) is necessary for a vertical photograph to cover an area of 9 km^2 ?
(A)	1500
(B)	150
(C)	15
(D)	15000

Q.56	An oblique aerial photograph of a cricket stadium is taken which includes two linear practice pitches (p and q). The length of both the pitches measured on ground is 15 m. The dimension of the image is 230 mm × 230 mm, while the photo lengths of p and q are 5 mm and 15 mm, respectively. What are the photo scales for p and q, respectively?
(A)	$\frac{1}{3000}$ and $\frac{1}{1000}$
(B)	$\frac{1}{1000}$ and $\frac{1}{3000}$
(C)	$\frac{1}{300}$ and $\frac{1}{100}$
(D)	$\frac{1}{100}$ and $\frac{1}{300}$
Q.57	Which one of the following statements is CORRECT?
(A)	The mean sea level is not the same as the geoid, but an approximation to the geoid
(B)	At least two tide gauges are required for estimating the mean sea level
(C)	The reference ellipsoid is always below the geoid
(D)	A geoid is realized by taking the mean of the tide gauge measurements at a point over a long period of time ($\geq$ 1 year)

Q.58	The vector [5, 3] in a right-handed planar coordinate system was transformed to a different coordinate system resulting in the vector [6.66, 12.20] using a four-parameter similarity transformation. Select the CORRECT set of transformation parameters from the choices given below. The transformation parameters are given in the following order: *scale, rotation angle, translation vector*. Hint: For a right-handed system, the rotation matrix $R(\theta)$ in two dimensions is given as $R(\theta) = \begin{bmatrix} cos\,\theta & -sin\,\theta \\ sin\,\theta & cos\,\theta \end{bmatrix}$.
(A)	2, 30°, [1, 2]
(B)	$1/2$, $-30°$, [2, 1]
(C)	$\sqrt{2}$, $-30°$, [1, 2]
(D)	$1/\sqrt{2}$, 30°, [2, 1]

Q.59	Identify the category of the map scales given below. P) 1:1000 Q) 1:5000 R) 1:50000 S) 1:100000
(A)	[P, Q] – large scale; [R, S] – small scale
(B)	[P, Q] – small scale; [R, S] – large scale
(C)	[P] – large scale; [Q, R, S] – small scale
(D)	[P] – small scale; [Q, R, S] – large scale
Q.60	Which of the following errors is/are eliminated by taking both left and right face observations in a theodolite?
(A)	Error due to line of collimation not being perpendicular to the horizontal axis
(B)	Error due to the horizontal axis not being perpendicular to the vertical axis
(C)	Error due to eccentricity of the verniers
(D)	Error due to imperfect graduations

Q.61	Which of the following statements in the context of aerial photography is/are CORRECT?
(A)	Oblique photographs are obtained when the camera axis is not normal to the datum plane
(B)	Tilted photographs are obtained when the camera axis is tilted from the nadir line
(C)	Vertical photographs are obtained when the camera axis is parallel to the datum plane
(D)	Vertical photographs are obtained when the photo plane is normal to the datum plane
Q.62	The angular misclosure of the closed-loop traverse shown in the figure is _____ ° (*Answer in decimal degrees and rounded off to three decimal places*) 

Q.63

The observations of a reciprocal levelling operation carried out from two stations A and B are given in table. It is known that the instrument has collimation error. The correct staff reading over station B when the instrument is set very near to station A is _____ m (*Rounded off to three decimal places*).

Assume all other errors are negligible.

	Staff readings at station	
Instrument set very near to station	A (m)	B (m)
A	1.275	2.005
B	1.040	1.660

Q.64

It is needed to establish the coordinates of a station A. Two stations B and C are available whose coordinates are given in the table.

Length of line CA = 1212.38 m; ∠BCA = 64°.

The Easting of station A is _____ m (*Rounded off to two decimal places*).

Assume station A lies to the west of the traverse line BC.

Station	**Easting (m)**	**Northing (m)**
B	11054.09	9484.37
C	10827.62	10112.15

Q.65

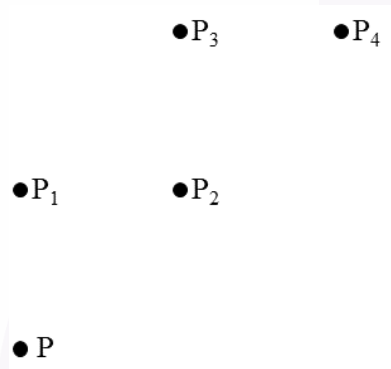
In a triangulation exercise, the horizontal distance between two points P and Q was found to be 12380.56 m. The average elevation along the line PQ was 748.82 m above the reference ellipsoid. The reduced horizontal distance between P and Q over the reference ellipsoid is _____ m (*Rounded off to two decimal places*).

Consider the radius of Earth to be 6378 km.

PART B: FOR Section II: Image Processing and Analysis CANDIDATES ONLY

Q.66 – Q.73 Carry ONE mark Each

Q.66	Which one of the following is NOT a linear raster operation?
(A)	Histogram equalization
(B)	Averaging filter
(C)	Convolution with a Gaussian kernel
(D)	Laplacian edge detection
Q.67	Which one of the following is responsible for attenuation of the incoming solar radiation in the atmosphere?
(A)	Absorption
(B)	Refraction
(C)	Transmission
(D)	Diffraction

Q.68	Consider the following arrangement of pixels P, P_1, P_2, P_3 and P_4 as shown in the figure. Assume that P, P_2 and P_4 have a value of 1, and P_1 and P_3 have a value of 0. If we consider adjacency of pixels as $V = \{1\}$, what is the length of the shortest m-path between P and P_4? 
(A)	2
(B)	1
(C)	3
(D)	4

Q.69	A square digital image of size 128 × 128 pixels requires 65536 bits of storage. What is the number of grey levels?
(A)	16
(B)	4
(C)	8
(D)	32
Q.70	Convolution of two digital images in the spatial domain corresponds to _____ in the frequency domain.
(A)	multiplication
(B)	convolution
(C)	addition
(D)	cross-correlation

Q.71	Select the CORRECT option(s). Aerial images are prone to external geometric errors due to random movements of the aircraft, which involve changes in _____.
(A)	altitude
(B)	attitude
(C)	terrain relief
(D)	focal length
Q.72	Which of the following statements in the context of image-to-image registration is/are CORRECT?
(A)	The images may belong to different dates
(B)	The images have significant overlapping geographic area
(C)	The images must have the same spatial resolution
(D)	The images must belong to the same dates

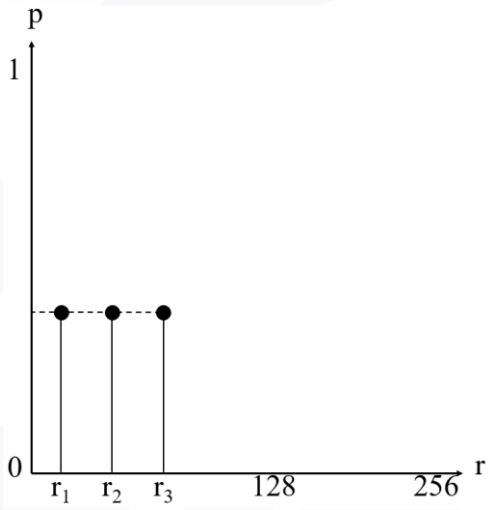
Q.73 Applying a 3 × 3 mean filter centered on the grey shaded pixel in the input image, shown in the figure, will result in an output value of _____ (*Answer in integer*).

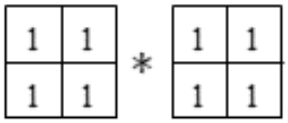
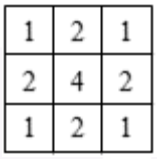
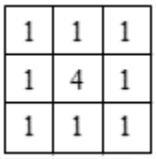
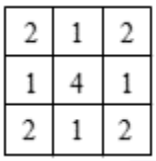
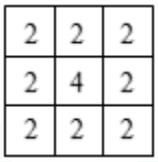
Input image

0	1	3	4	3	
2	**5**	4	5	2	
8	3	1	9	1	

Q.74 – Q.84 Carry TWO marks Each

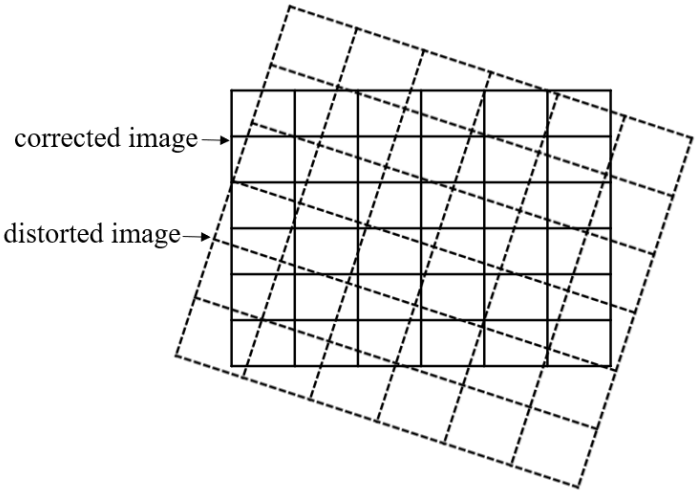
Q.74	What is the norm of the vector $f(x) = cos(x)$ in the inner product space $C([0, 2\pi])$? The inner product is defined by $\langle f(x),\ g(x)\rangle = \int_0^{2\pi} f(x).g(x)dx$
(A)	$\sqrt{\pi}$
(B)	$\sqrt{2\pi}$
(C)	0
(D)	$\sqrt{\pi/2}$

Q.75	Let $f(x, y)$ be an image with the histogram as shown in the figure. X-axis denotes grey levels (r) and Y-axis denotes the probability (p) of occurrence of the grey levels. What is the variance of the equalized image? 
(A)	2/27
(B)	3/27
(C)	2/3
(D)	1/27

Q.76	Which one of the following is the CORRECT outcome of convolution with zero padding of the two images given below? 
(A)	
(B)	
(C)	
(D)	

Q.77	Which of the following is/are CORRECT when using the Discrete Fourier Transform to compute convolution without zero padding?
(A)	Aliasing occurs
(B)	Wraparound error occurs
(C)	Convolution is linear
(D)	Aliasing can be avoided
Q.78	Which of the following vegetation indices is/are designed to jointly address the issues of atmospheric effect, background soil effect, and vegetation saturation effect?
(A)	EVI
(B)	NDVI
(C)	SAVI
(D)	LAI

Q.79	An 8-bit remote sensing image has brightness values ranging from 24 to 120. While applying the minimum-maximum contrast stretch, which of the following statements is/are CORRECT?
(A)	The original brightness values between 24 and 120 would be linearly distributed between 0 and 255
(B)	An original brightness value of 48 would become approximately 64
(C)	The original brightness values between 24 and 120 would be linearly distributed between 24 and 255
(D)	An original brightness value of 36 would become approximately 46

Q.80	A geometrically distorted image is corrected and the pixel values are assigned using resampling techniques as shown in the figure. In this context, which of the following options is/are CORRECT? 
(A)	Bilinear interpolation technique assigns the output pixel value based on a distance-weighted average of DN values of four (2 × 2) nearest pixels
(B)	Cubic interpolation technique assigns the output pixel value based on a distance-weighted average of DN values of sixteen (4 × 4) nearest pixels
(C)	Bilinear interpolation technique assigns the output pixel value based on a distance-weighted average of DN values of nine (3 × 3) nearest pixels
(D)	Cubic interpolation technique assigns the output pixel value based on a distance-weighted average of DN values of nine (3 × 3) nearest pixels

Q.81	Which of the following options is/are INCORRECT?
(A)	Negative images are formed by a non-linear transformation of digital images
(B)	A thresholding function is used to produce a two-level binary digital image
(C)	Logarithmic transformation of an image is used to expand the values of dark pixels in a digital image
(D)	Power law transformation with fractional exponent is used to map dark input values of an image into a wider range of output values
Q.82	While implementing the digital Laplacian filter mask, which of the following is/are the possible value(s) of the center pixel?
(A)	–4
(B)	–8
(C)	–2
(D)	–6

Q.83 An image analyst classifies an image into three classes, namely, water, vegetation and urban, using a simple classification technique. Using the reference data (ground truth) and classified data, the analyst prepares an error matrix, as shown in the table, and calculates accuracy values (*Rounded off to the nearest integer value*). Which of the following options is/are CORRECT?

	Land-cover classes	Reference data		
		Water	Vegetation	Urban
Classification data	Water	48	12	10
	Vegetation	8	16	16
	Urban	14	12	84

(A) Overall accuracy is 67%

(B) Producer's and User's accuracy values in case of water class are equal

(C) In case of urban class, Producer's accuracy is 20% and User's accuracy is 13%

(D) In case of vegetation class, Producer's accuracy is 20% and User's accuracy is 11%

Q.84 Principal Component Analysis (PCA) is applied on reflectance values obtained from seven bands. The following are the resultant eigenvalues.

0.39, 3.76, 13.10, 0.67, 101.00, 0.21, 0.12

The minimum number of principal components required to achieve at least 99% of total variance explained by seven bands is _____ (*Answer in integer*).