GATE Architecture and Planning

Sample Paper – 7

Duration: 128 Minutes **Maximum Marks: 72**

Instructions

- This paper contains **46 questions** covering the core **Architecture and Planning (AR)** subject of the GATE paper conducted by the IITs and IISc (General Aptitude and Engineering Mathematics are provided as separate papers).
- **Q1–Q20 carry 1 mark each** and **Q21–Q46 carry 2 marks each**, for a total of **72 marks**.
- Each question carries **negative marking of one-third of its allotted marks**: a wrong 1-mark question costs **0.33** and a wrong 2-mark question costs **0.67**. Unattempted questions carry no penalty.
- Every question here is a single-correct **MCQ**. The real GATE paper also has Multiple Select (MSQ) and Numerical Answer Type (NAT) questions, and **those carry no negative marking**.
- Attempt this paper in one timed sitting of about **128 minutes**, the share this core subject earns at GATE's overall pace of 180 minutes for 65 questions. Use standard code values (IS codes, NBC) and $g = 9.81$ m/s^2 unless stated otherwise.

Architecture, Design and History of Architecture

Q1. The great octagonal dome of the Florence Cathedral (Santa Maria del Fiore), raised without conventional external centering by means of a self-supporting double shell laid in a herringbone brick pattern, was engineered by: **[1 mark]**

(A) Leon Battista Alberti

(B) Donato Bramante

(C) Filippo Brunelleschi

(D) Andrea Palladio

Q2. The Villa Rotonda (Villa Almerico Capra) near Vicenza, a strictly symmetrical square plan with a central domed hall and four identical temple-front porticoes, one on each face, was designed by the Renaissance architect: **[1 mark]**

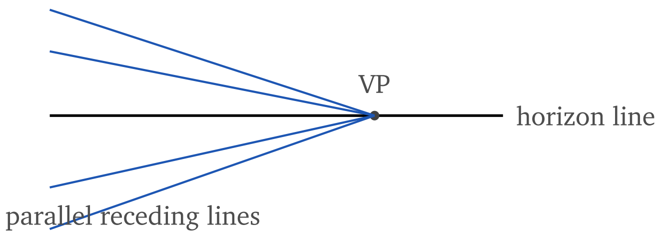
(A) Michelangelo Buonarroti

(B) Filippo Brunelleschi

(C) Gian Lorenzo Bernini

(D) Andrea Palladio

Q3. In linear perspective, first formalised during the Italian Renaissance, a set of parallel horizontal lines receding away from the viewer appears to converge to a single point lying on the horizon line, as shown. That point of convergence is called the: **[1 mark]**



(A) Station point

(B) Picture plane

(C) Vanishing point

(D) Ground line

Q4. St. Peter's Square in Rome, framed by a vast elliptical Tuscan colonnade whose two curved arms are said to embrace the visitor, is a landmark of Baroque urban design created by: **[1 mark]**

(A) Gian Lorenzo Bernini

(B) Francesco Borromini

(C) Andrea Palladio

(D) Christopher Wren

Q5. The first printed architectural treatise of the Renaissance, *De re aedificatoria* (On the Art of Building), which revived and systematised the ideas of the Roman writer Vitruvius, was written by: **[1 mark]**

(A) Filippo Brunelleschi

(B) Leon Battista Alberti

(C) Sebastiano Serlio

(D) Giacomo della Porta

Q6. Which of the following is the most characteristic feature of Baroque architecture of the 17th century, setting it apart from the calm, static restraint of the earlier Renaissance? **[1 mark]**

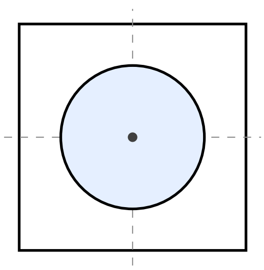
(A) Dynamic curved forms, dramatic movement and a bold theatrical play of light and shade

(B) Strictly horizontal trabeated post-and-beam construction

(C) Pointed arches, ribbed vaults and flying buttresses

(D) Unornamented flat surfaces and continuous ribbon windows

Q7. The plan form sketched below, organised about a single central point with equal (radial) development on all sides – the Renaissance ideal for a church – is described as a: **[1 mark]**



central point

(A) Basilican (longitudinal) plan

(B) Linear plan

(C) Centralised (radial) plan

(D) Cluster plan

Q8. The Roman writer Vitruvius held that a well-designed building must satisfy three qualities – *firmitas*, *utilitas* and *venustas*. These are commonly translated, in order, as: **[1 mark]**

(A) firmness (durability), commodity (function) and delight (beauty)

(B) cost, speed and durability

(C) light, ventilation and drainage

(D) symmetry, rhythm and proportion

Building Construction, Materials and Management

Q9. In a three-coat plaster applied to a masonry wall, the first (base) coat laid directly on the wall to even out irregularities and to provide a mechanical key for the coats that follow is called the: **[1 mark]**

(A) Setting (finishing) coat

(B) Rendering coat

(C) Floating coat

(D) Skimming coat

Q10. A common traditional method of giving a flat R.C.C. roof slab a water-resistant finish together with a fall towards the rainwater outlets is to lay a: **[1 mark]**

(A) suspended false ceiling below the slab

(B) plaster coat on the underside (soffit) of the slab

(C) single coat of distemper on the top surface

(D) brick-bat coba (lime-surkhi) waterproofing course graded to slope towards the outlets

Q11. In a passenger lift (elevator) of the traction type, the counterweight suspended over the driving sheave opposite the car serves mainly to: **[1 mark]**

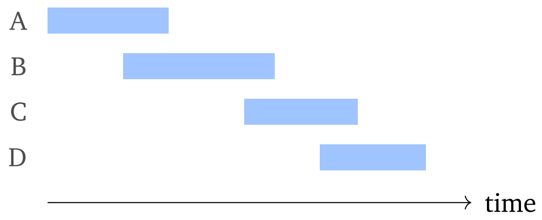
(A) act only as a safety brake should all the hoisting ropes fail

(B) balance the weight of the car and part of the rated load, so the motor works only against the unbalanced load

(C) keep the car centred within the guide rails of the shaft

(D) cushion the impact of the car at the bottom of the shaft

Q12. The project-management chart shown, in which each activity is drawn as a horizontal bar set against a time scale, the length of the bar being proportional to the duration of the activity, is a: **[1 mark]**



(A) Gantt (bar) chart

(B) Pie chart

(C) Histogram

(D) Organisation chart

Q13. White Portland cement differs from ordinary grey Portland cement mainly because it is manufactured from raw materials kept very low in: **[1 mark]**

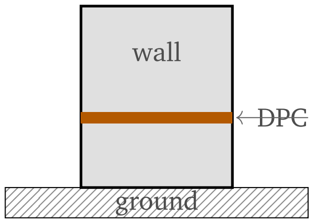
(A) iron oxide and manganese oxide

(B) calcium oxide

(C) silica

(D) alumina

Q14. In the wall section shown, the continuous impervious layer provided at plinth level to stop moisture from the ground rising up into the superstructure wall is the: [1 mark]



(A) Coping

(B) String course

(C) Weep hole

(D) Damp-proof course (DPC)

Q15. In building estimation, the *plinth area* of a single-storey building is measured as: [1 mark]

(A) the carpet (usable) area available to the occupants only

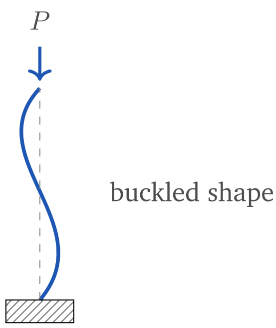
(B) the sum of the floor areas of all storeys taken together

(C) the plot area left after deducting the mandatory setbacks

(D) the covered built-up area at floor level, measured to the outer face of the external walls

Building Structures and Systems

Q16. A long slender column loaded axially tends to fail not by crushing of the material but by a sudden sideways bending at a load well below the crushing load, as shown. This mode of failure is called: [1 mark]



(A) Buckling

(B) Shear failure

(C) Torsional failure

(D) Bearing failure

Q17. The slenderness ratio of a column, which decides whether it behaves as a short (crushing) or a long (buckling) column, is defined as the ratio of the: **[1 mark]**

(A) effective length to the least radius of gyration of the section

(B) cross-sectional area to the length

(C) axial load to the cross-sectional area

(D) breadth to the depth of the section

Q18. For a column of a given material, length and cross-section, the Euler critical buckling load is the *largest* when its two ends are: **[1 mark]**

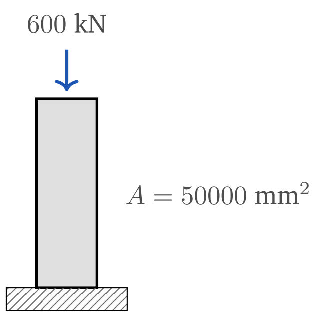
(A) one end fixed and the other free (cantilever)

(B) both ends fixed

(C) both ends hinged (pinned)

(D) one end fixed and the other hinged

Q19. A short column of cross-sectional area $50000\ \text{mm}^2$ carries an axial compressive load of 600 kN, as shown. The average direct (axial) compressive stress in the column is: **[1 mark]**



(A) $6\ \text{N/mm}^2$

(B) $30\ \text{N/mm}^2$

(C) $12\ \text{N/mm}^2$

(D) $120\ \text{N/mm}^2$

Q20. In a conventional framed building, the correct downward path by which gravity (vertical) loads are carried to the ground is: **[1 mark]**

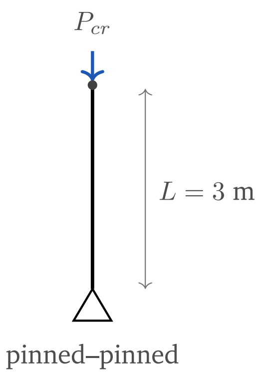
(A) column $\rightarrow$ beam $\rightarrow$ slab $\rightarrow$ soil

(B) footing $\rightarrow$ column $\rightarrow$ beam $\rightarrow$ slab

(C) beam $\rightarrow$ slab $\rightarrow$ footing $\rightarrow$ column

(D) slab $\rightarrow$ beam $\rightarrow$ column $\rightarrow$ footing $\rightarrow$ soil

Q21. A steel column of length 3 m is pinned at both ends, as shown. Its cross-section has a flexural rigidity $EI = 4000\ \text{kN} \cdot \text{m}^2$. Using Euler's formula $P_{cr} = \dfrac{\pi^2 EI}{L_e^2}$ with $\pi^2 \approx 9.87$, the critical buckling load is nearest to: **[2 marks]**



(A) 2193 kN

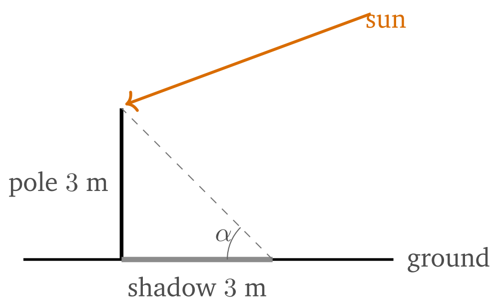
(B) 4387 kN

(C) 8773 kN

(D) 1316 kN

Environmental Design and Building Services

Q22. A vertical pole 3 m high casts a shadow 3 m long on level ground when the sun is at an altitude angle α, as shown. The solar altitude angle α measured from the horizontal is: **[2 marks]**



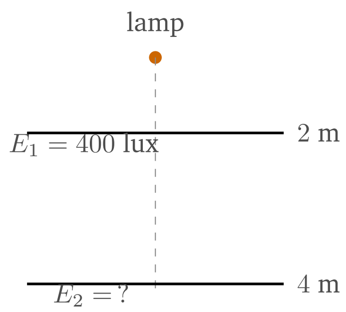
(A) 30°

(B) 60°

(C) 45°

(D) 90°

Q23. The illuminance produced on a surface directly below a small (point) lamp obeys the inverse-square law, as illustrated. If the illuminance is 400 lux at a distance of 2 m below the lamp, then at 4 m directly below it the illuminance becomes: **[2 marks]**



(A) 200 lux

(B) 100 lux

(C) 800 lux

(D) 50 lux

Q24. Among the following lamps, the one with the highest luminous efficacy (lumens per watt), and hence the most energy-efficient choice for interior lighting, is the: **[2 marks]**

(A) Incandescent (GLS) lamp

(B) Halogen lamp

(C) LED lamp

(D) Ordinary tungsten filament lamp

Q25. In a building's electrical installation, the main purpose of providing an earthing (grounding) system is to: **[2 marks]**

(A) raise the supply voltage delivered to the appliances

(B) provide a low-resistance path so that fault/leakage current flows safely to earth, protecting persons from electric shock

(C) reduce the monthly electricity bill

(D) improve the colour rendering of the lamps

Q26. The daylight factor at a point inside a room is defined as the ratio, expressed as a percentage, of the: **[2 marks]**

(A) direct sunlight to the diffuse skylight at that point

(B) glazed window area to the floor area of the room

(C) illuminance at the indoor point to the simultaneous horizontal illuminance from an unobstructed sky outdoors

(D) output of the artificial lamps to the area of the room

Q27. In estimating the maximum demand of a building's electrical installation, a diversity factor is applied because: **[2 marks]**

(A) every connected load always runs at full power at the same instant

(B) not all the connected loads operate simultaneously at full load, so the maximum demand is less than the total connected load

(C) the supply voltage keeps changing through the day

(D) cables lose part of the power as heat

Q28. One "ton of refrigeration" (TR), the unit of cooling capacity commonly used in air-conditioning design, corresponds to a rate of heat removal of about: **[2 marks]**

(A) 3.5 kW

(B) 1.0 kW

(C) 10 kW

(D) 0.75 kW

Urban Design and Landscape Architecture

Q29. The conservation approach in which a heritage building is given a new, compatible contemporary use while its historic fabric and character are retained (for example an old mill turned into a museum) is called: **[2 marks]**

(A) Demolition

(B) Reconstruction

(C) Gentrification

(D) Adaptive reuse

Q30. The international charter of 1964 that laid down the foundational principles for the conservation and restoration of monuments and sites, widely followed in heritage practice, is the: **[2 marks]**

(A) Athens Treaty

(B) Nairobi Recommendation

(C) Venice Charter

(D) Kyoto Protocol

Q31. In India, the statutory body responsible for the protection, conservation and upkeep of centrally protected monuments of national importance is the: **[2 marks]**

(A) Central Public Works Department (CPWD)

(B) Town and Country Planning Organisation (TCPO)

(C) National Building Organisation (NBO)

(D) Archaeological Survey of India (ASI)

Q32. In heritage regulation, a "listed building" is one that: **[2 marks]**

(A) merely appears in a real-estate sale listing

(B) has been officially entered on a statutory register of buildings of special architectural or historic interest and is legally protected against unregulated alteration or demolition

(C) is simply the tallest building in its precinct

(D) is any building more than ten years old

Q33. In heritage conservation planning, the surrounding area of controlled development around a protected monument, within which building heights and activities are regulated to safeguard the monument's setting, is called the: **[2 marks]**

(A) off-street car parking zone

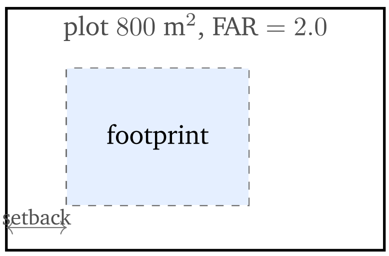
(B) central business district

(C) agricultural green belt

(D) buffer (regulated) zone around the monument

Urban and Regional Planning and Housing

Q34. A plot of area $800\ \text{m}^2$ is permitted a Floor Area Ratio (FAR/FSI) of 2.0, within the setbacks shown. If each floor of the building covers a ground footprint of $320\ \text{m}^2$, the maximum number of equal floors that may be built is: **[2 marks]**



(A) 2

(B) 3

(C) 4

(D) 5

Q35. The Master Plan (Development Plan) of a city is primarily a: **[2 marks]**

(A) detailed working drawing for the construction of a single building

(B) annual municipal budget statement

(C) long-range statutory document guiding the physical growth and land-use of a city, usually over a 20–25 year horizon

(D) map showing only the network of roads in the city

Q36. Under common norms for Economically Weaker Section (EWS) housing in Indian schemes, the minimum carpet area of a dwelling unit is of the order of: **[2 marks]**

(A) $10\ m^2$

(B) $30\ m^2$

(C) $100\ m^2$

(D) $200\ m^2$

Q37. The city of Chandigarh, laid out on a grid of largely self-sufficient rectangular "sectors" each about 800 m $\times$ 1200 m with a clear hierarchy of roads, was master-planned by: **[2 marks]**

(A) Edwin Lutyens

(B) Otto Koenigsberger

(C) Patrick Geddes

(D) Le Corbusier

Q38. A residential neighbourhood houses a population of 12000 persons on a net residential area of 40 hectares. The net residential density of the neighbourhood is: **[2 marks]**

(A) 120 persons/ha

(B) 480 persons/ha

(C) 200 persons/ha

(D) 300 persons/ha

Q39. The continuous, extended urban region formed when several separately growing towns spread until they merge into one large built-up mass – a term coined by Patrick Geddes – is a: [2 marks]

(A) Conurbation

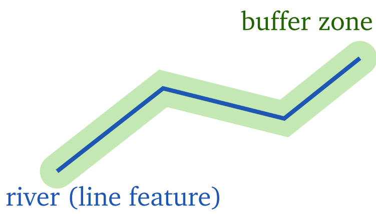
(B) Green belt

(C) Satellite town

(D) Ribbon development

Planning Techniques, Surveying and GIS

Q40. In a Geographic Information System, the operation that generates a zone of a specified width around a point, line or polygon feature (for example a 100 m protection strip along a river), as shown, is called a: [2 marks]



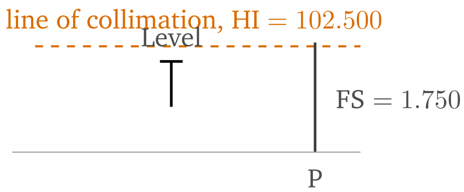
(A) Buffer operation

(B) Georeferencing

(C) Digitising

(D) Interpolation

Q41. In differential levelling, the height of instrument (line of collimation) has been established as 102.500 m. A foresight staff reading of 1.750 m is then taken on a point P, as shown. The reduced level (RL) of point P is: [2 marks]



(A) 104.250 m

(B) 100.750 m

(C) 102.500 m

(D) 1.750 m

Q42. A town's population rose from 40000 to 60000 over the last two decades, an average increase of 10000 per decade. Using the arithmetic increase method of population forecasting, the projected population one decade after the latest census is: **[2 marks]**

(A) 60000

(B) 65000

(C) 70000

(D) 80000

Q43. A map is drawn to a representative fraction (RF) of $1 : 25000$. A straight distance measured as 8 cm on the map corresponds to an actual ground distance of: **[2 marks]**

(A) 0.2 km

(B) 20 km

(C) 2 km

(D) 200 km

Infrastructure, Services and Transportation Planning

Q44. In traffic volume studies on mixed-traffic Indian roads, the "Passenger Car Unit" (PCU) is used to: **[2 marks]**

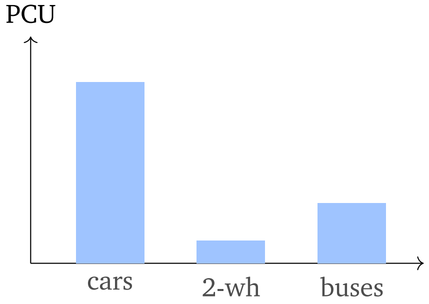
(A) convert a heterogeneous traffic stream of different vehicle types into an equivalent number of standard passenger cars

(B) count only the number of passengers seated inside the cars

(C) measure the fuel consumed by a passenger car

(D) fix the fare charged by public transport

Q45. During a peak hour, a road carries 900 cars (PCU 1.0 each), 200 two-wheelers (PCU 0.5 each) and 100 buses (PCU 3.0 each), as summarised in the chart. The total traffic volume expressed in PCU per hour is: **[2 marks]**



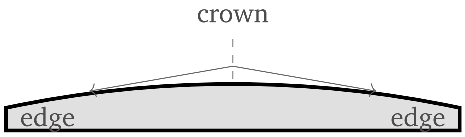
(A) 1200

(B) 1300

(C) 1000

(D) 1500

Q46. The slight transverse slope given to a road surface, falling from the crown at the centre towards both edges as shown, so that rainwater drains off the carriageway, is called the: **[2 marks]**



(A) Camber (cross-slope)

(B) Superelevation

(C) Gradient

(D) Right-of-way

Detailed Solutions

Q1.

Solution

Concept – the Florence dome and its builder: The dome of Santa Maria del Fiore is a landmark that marks the start of Renaissance engineering.

Step 1 – recall the technical problem: The octagonal drum was too wide to span with a timber centering of the usual kind.

Step 2 – recall the solution and its author: Filippo Brunelleschi devised a self-supporting double shell of brick laid in a herringbone (spina-pesce) bond, so the masonry could be built ring by ring without full centering.

Step 3 – confirm the attribution: The dome, completed in 1436, is universally credited to Brunelleschi.

Why the other options are wrong:

- Alberti was a theorist and designer (for example Santa Maria Novella facade) but did not build this dome.
- Bramante worked later, in Rome, on the first design for St. Peter's.
- Palladio belongs to the later 16th century in the Veneto.

Final Answer: Filippo Brunelleschi $\Rightarrow$ $\boxed{\text{C}}$

$\boxed{\textbf{Answer: (C)}}$ **Go Back to Q1**

Q2.

Solution

Concept – the Palladian villa and its symmetry: The Villa Rotonda is the model of the centrally planned Renaissance villa.

Step 1 – read the described features: A square plan, a central circular domed hall, and four identical temple-front porticoes, one on each of the four faces.

Step 2 – match to the architect: This fourfold symmetry about a central rotunda is the hallmark of Andrea Palladio's villa near Vicenza.

Step 3 – note the influence: The type was later copied across Europe and America (for example Chiswick House and Monticello).

Why the other options are wrong:

- Michelangelo is known for the Laurentian Library and the later dome of St.

Peter's, not this villa.

- Brunelleschi belongs to the early Renaissance in Florence.
- Bernini is a Baroque sculptor-architect of the following century.

Final Answer: Andrea Palladio $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q2

Q3.

Solution

Concept – the geometry of linear perspective: Renaissance perspective is a system for representing depth on a flat surface.

Step 1 – recall the rule for parallel lines: Lines that are parallel in the real scene, and that run away from the observer, appear to draw together as they recede.

Step 2 – locate where they meet: They meet at a single point placed on the horizon line; this is the **vanishing point**.

Step 3 – read the figure: The four receding lines in the sketch all converge on the point marked VP on the horizon, which is the vanishing point.

Why the other options are wrong:

- The station point is the position of the observer's eye, not a point on the drawing.
- The picture plane is the transparent plane on which the view is projected.
- The ground line is where the picture plane meets the ground, not the point of convergence.

Final Answer: Vanishing point $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – Baroque urban set-pieces: The Baroque age used sweeping curved forms to shape grand public space.

Step 1 – read the described design: A huge elliptical colonnade of Tuscan columns, forming two curved arms that reach out towards the visitor in front of a church.

Step 2 – name the work and its author: This is the piazza of St. Peter's in Rome, designed by Gian Lorenzo Bernini in the mid-17th century.

Step 3 – confirm the idiom: The dynamic ellipse and the theatrical embrace are pure Baroque, and Bernini was its leading figure.

Why the other options are wrong:

- Borromini, Bernini's rival, designed smaller Baroque churches (San Carlo alle Quattro Fontane), not this piazza.
- Palladio is a 16th-century classicist, earlier than the Baroque.
- Christopher Wren worked in England (St. Paul's, London), not on St. Peter's Square.

Final Answer: Gian Lorenzo Bernini $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – Renaissance architectural theory: The Renaissance revived the writings of antiquity and produced its own treatises.

Step 1 – identify the treatise: *De re aedificatoria*, the first printed book on architecture, was modelled on Vitruvius and set out the theory of building in ten books.

Step 2 – name the author: It was written by Leon Battista Alberti in the mid-15th century.

Step 3 – note its role: It became the theoretical foundation for later Renaissance design.

Why the other options are wrong:

- Brunelleschi was a builder who left no such treatise.
- Serlio and della Porta wrote later; Serlio's books came in the 16th century and della Porta was a practising architect, not the author of *De re aedificatoria*.

Final Answer: Leon Battista Alberti $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – what distinguishes the Baroque from the Renaissance: Both use the classical vocabulary, but they handle it very differently.

Step 1 – recall the Renaissance character: The Renaissance is calm, balanced, static and clearly ordered.

Step 2 – recall the Baroque character: The Baroque is dynamic: it uses curved and undulating walls, strong diagonals, movement, and a dramatic contrast of light and shade (chiaroscuro) to stir emotion.

Step 3 – pick the matching option: Dynamic curved forms, movement and theatrical light-and-shade describe the Baroque exactly.

Why the other options are wrong:

- Horizontal trabeated post-and-beam work describes ancient Greek architecture.
- Pointed arches, ribbed vaults and flying buttresses describe Gothic architecture.
- Flat unornamented surfaces and ribbon windows describe 20th-century Modernism.

Final Answer: Dynamic curved forms and dramatic light and shade $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – classifying plan organisation: A plan can be read by how its parts are arranged about an ordering geometry.

Step 1 – read the figure: The form is developed equally in all directions about one central point, with two axes of symmetry crossing at the centre.

Step 2 – name the organisation: A composition built around a dominant central space with equal radial development is a **centralised (radial) plan**. The Renaissance ideal church (a circle, square or Greek cross) is the classic example.

Why the other options are wrong:

- A basilican (longitudinal) plan is stretched along one main axis, like a nave, not centred on a point.

- A linear plan strings spaces along a line.
- A cluster plan groups spaces by proximity without a single dominating centre.

Final Answer: Centralised (radial) plan $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q7

Q8.

Solution

Concept – Vitruvius and the three qualities of good building: Vitruvius, in *De architectura*, named three tests every building should pass.

Step 1 – translate each Latin term: *Firmitas* is firmness or structural durability; *utilitas* is usefulness or fitness for purpose; *venustas* is beauty or delight.

Step 2 – give the well-known English form: Sir Henry Wotton rendered them as "commodity, firmness and delight", that is function, stability and beauty.

Step 3 – match the option in the given order: Firmness (durability), commodity (function) and delight (beauty) matches *firmitas*, *utilitas*, *venustas*.

Why the other options are wrong:

- Cost, speed and durability are project constraints, not the Vitruvian triad.
- Light, ventilation and drainage are servicing requirements.
- Symmetry, rhythm and proportion are ordering principles, not the three Vitruvian qualities.

Final Answer: firmness, commodity and delight $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q8

Q9.

Solution

Concept – the coats of a three-coat plaster: A good plaster is built up in successive coats, each with a name and a job.

Step 1 – name the first coat: The first coat, applied straight onto the masonry to fill hollows and to give a rough key, is the **rendering coat** (also called the scratch or first coat).

Step 2 – name the following coats: Over it comes the floating coat, which brings the surface to a true, even plane, and finally the thin setting (finishing) coat, which gives the smooth surface.

Step 3 – pick the base coat: The base coat asked for is therefore the rendering coat.

Why the other options are wrong:

- The setting (finishing) coat is the last, thin coat.
- The floating coat is the middle levelling coat.
- "Skimming" is a thin finishing operation, not the base coat.

Final Answer: Rendering coat $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Q10.

Solution

Concept – waterproofing a flat roof: A flat R.C.C. roof needs both a water-resistant top surface and a slope to shed rain.

Step 1 – recall the traditional treatment: A layer of broken brick pieces set in lime mortar, called **brick-bat coba**, is laid over the slab.

Step 2 – explain how it works: The coba is graded to fall gently towards the rainwater outlets (usually a slope of about 1 in 100), so water runs off, and the lime-surkhi matrix resists water penetration; the finished surface is often marked into panels.

Step 3 – match the option: Laying a brick-bat coba course with slope to the outlets is the correct method.

Why the other options are wrong:

- A false ceiling below the slab is for appearance and services, not waterproofing.
- Plastering the soffit treats the underside, not the exposed top.
- Distemper is an interior finish and gives no waterproofing.

Final Answer: Brick-bat coba with slope to the outlets $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q10

Q11.

Solution

Concept – how a traction lift is balanced: A traction lift raises the car with ropes passing over a driven sheave.

Step 1 – describe the counterweight: A counterweight hangs from the other end of the ropes, on the opposite side of the sheave from the car.

Step 2 – state its purpose: It is made to weigh the same as the empty car plus about 40–50% of the rated load, so it balances most of the load. The motor then has to move only the small *out-of-balance* weight, which greatly reduces the power and energy needed.

Step 3 – match the option: Balancing the car and part of the load, so the motor works only against the unbalanced load, is the correct function.

Why the other options are wrong:

- Safety against rope failure is the job of the safety gear and governor, not the counterweight.
- Centring in the shaft is done by the guide rails and shoes.
- Impact at the pit bottom is absorbed by the buffers.

Final Answer: It balances the car and part of the load $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q11

Q12.

Solution

Concept – charts used in construction planning: Different charts present project information in different ways.

Step 1 – read the figure: Each activity (A, B, C, D) is shown as a horizontal bar drawn against a common time axis, and the length of a bar equals the duration of that activity.

Step 2 – name the chart: A time-scaled bar chart of activities is a **Gantt chart** (bar chart), the simplest tool for showing a construction schedule.

Why the other options are wrong:

- A pie chart shows parts of a whole as sectors of a circle.
- A histogram shows the frequency distribution of a variable, not a time schedule.

- An organisation chart shows the hierarchy of people/roles, not activity durations.

Final Answer: Gantt (bar) chart $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept – why white cement is white: The grey colour of ordinary cement comes from certain metal oxides.

Step 1 – identify the colouring oxides: The grey tint is mainly due to iron oxide, with some manganese oxide, present in the clinker.

Step 2 – state the requirement for white cement: To make white cement, the raw materials (limestone and china clay) are chosen to be very low in iron and manganese oxides, and clean fuel and grinding media are used to avoid contamination.

Step 3 – match the option: Being low in iron oxide and manganese oxide is what gives white cement its colour.

Why the other options are wrong:

- Calcium oxide (lime) is the main constituent of all Portland cements and is not reduced.
- Silica and alumina are essential cement-forming oxides and are not what is minimised for colour.

Final Answer: Low iron oxide and manganese oxide $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q13

Q14.

Solution

Concept – preventing rising damp in walls: Ground moisture can climb a wall by capillary action unless it is stopped.

Step 1 – read the section: A continuous impervious layer is shown built into the wall at plinth level, right above the ground.

Step 2 – name it: This horizontal barrier is the **damp-proof course (DPC)**. It is made of an impervious material (such as dense cement concrete, bitumen or a bituminous membrane) and it breaks the capillary path so that water cannot rise into the superstructure.

Why the other options are wrong:

- A coping is the protective top on a parapet or free-standing wall.
- A string course is a projecting horizontal band for appearance.
- A weep hole drains water trapped behind a wall; it does not seal against rising damp.

Final Answer: Damp-proof course (DPC) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q14

Q15.

Solution

Concept – the meaning of plinth area: Estimation uses several defined "areas", each measured a set way.

Step 1 – define plinth area: The plinth area is the built-up covered area of a building measured at floor (plinth) level, taken to the *outer* face of the external walls.

Step 2 – note what it includes: It includes the walls themselves and internal circulation, so it is larger than the carpet area; it is the basis of the plinth-area rate method of preliminary estimation.

Step 3 – match the option: The covered built-up area at floor level, measured to the outer face of external walls, is correct.

Why the other options are wrong:

- The carpet area is the net usable floor area inside the walls, which is smaller.
- The sum of floor areas of all storeys is the total floor area, not the plinth area of one storey.
- The plot area minus setbacks is the buildable ground coverage limit, a planning quantity, not the plinth area.

Final Answer: Covered built-up area to the outer face of external walls $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q15

Q16.

Solution

Concept – the failure of slender columns: Columns can fail either by crushing of the material or by instability.

Step 1 – describe the behaviour: A long, slender column, when loaded axially, stays straight up to a certain load; beyond it, the column suddenly bows out sideways even though the average stress is still well below the crushing strength.

Step 2 – name the phenomenon: This sudden lateral deflection under axial load is **buckling**, an instability failure governed by Euler's theory.

Step 3 – read the figure: The column in the sketch has bowed into a curved shape under the axial load P, which is buckling.

Why the other options are wrong:

- Shear failure is sliding along a plane, not lateral bowing.
- Torsional failure is twisting under a torque.
- Bearing failure is local crushing where a load is applied, again not lateral instability.

Final Answer: Buckling $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept – the slenderness ratio of a column: Slenderness measures how "thin and long" a column is.

Step 1 – write the definition: Slenderness ratio $= \dfrac{L_e}{r_{\min}}$, where L_e is the effective length and $r_{\min}$ is the least radius of gyration of the cross-section.

Step 2 – explain its meaning: A high value means a long, slender column that will fail by buckling; a low value means a short, stocky column that will fail by crushing.

Step 3 – match the option: Effective length to least radius of gyration is the correct definition.

Why the other options are wrong:

- Area to length, load to area, and breadth to depth are all different ratios and none is the slenderness ratio.

Final Answer: Effective length / least radius of gyration $\Rightarrow \boxed{A}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept – effect of end conditions on the Euler load: The end restraint of a column decides its effective length, and hence its buckling load.

Step 1 – write the Euler load: $P_{cr} = \dfrac{\pi^2 EI}{L_e^2}$, so a *smaller* effective length L_e gives a *larger* critical load.

Step 2 – list the effective lengths: For a real length L: both fixed $L_e = 0.5L$; fixed–hinged $L_e = 0.7L$; both hinged $L_e = 1.0L$; fixed–free (cantilever) $L_e = 2.0L$.

Step 3 – pick the smallest L_e: Both ends fixed gives the smallest $L_e = 0.5L$, hence the highest P_{cr}.

Why the other options are wrong:

- The cantilever ($L_e = 2L$) gives the *lowest* buckling load.
- Both hinged ($L_e = L$) and fixed–hinged ($L_e = 0.7L$) both give a lower load than both-fixed.

Final Answer: Both ends fixed $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept – average axial stress in a short column: Direct stress is force divided by the area resisting it.

Step 1 – write the formula: $\sigma = \dfrac{P}{A}$

Step 2 – convert the load to newtons: $P = 600 \text{ kN} = 600 \times 1000 = 600000 \text{ N}$

Step 3 – substitute the values: $\sigma = \dfrac{600000 \text{ N}}{50000 \text{ mm}^2}$

Step 4 – divide: $\sigma = 12 \text{ N/mm}^2$

Step 5 – state the result: The average compressive stress is 12 N/mm^2 ($= 12$ MPa).

Why the other options are wrong:

- 6 N/mm^2 would need double the area (100000 mm^2).
- 30 N/mm^2 and 120 N/mm^2 come from mis-scaling the load (using 1500 kN, or forgetting a factor of 10).

Final Answer: 12 N/mm^2 $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q19

Q20.

Solution

Concept – the gravity load path in a framed building: Loads must travel through the structure to the ground in a definite order.

Step 1 – trace the path: Occupant and self-weight loads first rest on the *slab*; the slab hands them to the *beams* that support it; the beams pass them to the *columns*; the columns carry them to the *footings*; the footings spread them into the *soil*.

Step 2 – write the sequence: slab $\rightarrow$ beam $\rightarrow$ column $\rightarrow$ footing $\rightarrow$ soil.

Step 3 – match the option: This is exactly option D.

Why the other options are wrong:

- The other three sequences reverse the order (starting from the column, footing or beam), which is not how gravity loads flow downward.

Final Answer: slab $\rightarrow$ beam $\rightarrow$ column $\rightarrow$ footing $\rightarrow$ soil $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept – Euler buckling load of a pinned column: The critical load follows Euler's formula once the effective length is known.

Step 1 – fix the effective length: For a column pinned (hinged) at both ends, $L_e = L = 3$ m.

Step 2 – write Euler's formula: $P_{cr} = \dfrac{\pi^2 EI}{L_e^2}$

Step 3 – substitute the data: $P_{cr} = \dfrac{9.87 \times 4000}{(3)^2}$

Step 4 – evaluate the numerator: $9.87 \times 4000 = 39480$

Step 5 – evaluate the denominator: $(3)^2 = 9$

Step 6 – divide: $P_{cr} = \dfrac{39480}{9} = 4386.7 \text{ kN} \approx 4387 \text{ kN}$

Why the other options are wrong:

- 2193 kN is half the correct value (wrongly using $L_e = 0.7L$ or halving).
- 8773 kN is double (using $L_e = 0.7L$ mis-scaled, or $\times 2$).
- 1316 kN uses $L_e = 2L$ (a cantilever), which is not the case here.

Final Answer: $4387 \text{ kN} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q21

Q22.

Solution

Concept – solar altitude from shadow length: The altitude angle links the height of an object to the length of its shadow.

Step 1 – set up the right triangle: The pole (height h), its shadow (length s) and the sun's ray form a right-angled triangle, with the altitude angle α at the tip of the shadow.

Step 2 – write the relation: $\tan\alpha = \dfrac{h}{s}$ (height opposite the angle over the shadow adjacent to it).

Step 3 – substitute the values: $\tan\alpha = \dfrac{3}{3} = 1$

Step 4 – solve for α: $\alpha = \tan^{-1}(1) = 45^\circ$

Step 5 – interpret: When the shadow length equals the object height, the sun stands at 45° above the horizon.

Why the other options are wrong:

- 30° needs a shadow $\sqrt{3}$ times the height (≈ 5.2 m).
- 60° needs a shadow of only 1.73 m.
- 90° (sun overhead) would give zero shadow.

Final Answer: $45^\circ \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q22

Q23.

Solution

Concept – the inverse-square law of illumination: The illuminance from a point source falls off with the square of the distance.

Step 1 – write the law: $E \propto \frac{1}{d^2}$, so $\frac{E_2}{E_1} = \left(\frac{d_1}{d_2}\right)^2$.

Step 2 – put in the distances: $\frac{E_2}{E_1} = \left(\frac{2}{4}\right)^2$

Step 3 – simplify the ratio: $\left(\frac{2}{4}\right)^2 = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$

Step 4 – find E_2: $E_2 = \frac{1}{4} \times 400 = 100$ lux

Step 5 – interpret: Doubling the distance from 2 m to 4 m cuts the illuminance to one-quarter.

Why the other options are wrong:

- 200 lux assumes a simple inverse (1/d), not inverse-square.
- 800 lux and 50 lux come from multiplying instead of dividing, or from the wrong power.

Final Answer: 100 lux $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept – luminous efficacy of lamps: Efficacy (lumens per watt) tells how much light a lamp gives for the power it draws.

Step 1 – recall typical efficacies: Incandescent/GLS and tungsten lamps give roughly 10–15 lm/W; halogen about 15–25 lm/W; modern LED lamps give of the order of 80–150 lm/W.

Step 2 – pick the highest: The **LED lamp** has by far the highest efficacy and so is the most energy-efficient of the four.

Step 3 – note the practical point: Higher efficacy means the same light output for much less electrical power and heat.

Why the other options are wrong:

- Incandescent (GLS) and plain tungsten filament lamps waste most of their

energy as heat and have the lowest efficacy.
- Halogen is better than incandescent but still far below LED.

Final Answer: LED lamp $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q24

Q25.

Solution

Concept – the purpose of earthing: Earthing connects the metal parts of an installation to the general mass of earth.

Step 1 – state the main aim: Its chief purpose is safety: it provides a deliberate low-resistance path to earth for any fault or leakage current.

Step 2 – explain the protection: If a live conductor touches a metal enclosure, the fault current flows to earth through this path, keeping the enclosure near earth potential and quickly operating the fuse or breaker, so a person touching the metal is protected from electric shock.

Step 3 – match the option: Providing a low-resistance path for fault current to earth, protecting persons from shock, is the correct purpose.

Why the other options are wrong:

- Earthing does not raise the supply voltage.
- It does not reduce the electricity bill.
- It has nothing to do with the colour rendering of lamps.

Final Answer: Safe low-resistance path to earth for fault current $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

Concept – the daylight factor: The daylight factor is a standard measure of how well-daylit a point in a room is.

Step 1 – write the definition: Daylight factor (DF) $= \dfrac{E_{\text{indoor}}}{E_{\text{outdoor}}} \times 100\%$, where E_{indoor} is the illuminance at the indoor point and E_{outdoor} is the illuminance on a horizontal plane outdoors under an unobstructed sky at the same moment.

Step 2 – note why a ratio is used: Because it is a ratio to the simultaneous outdoor value, the DF stays constant as the sky brightness changes, which makes it a stable design measure (usually of the CIE overcast sky).

Step 3 – match the option: Indoor illuminance to simultaneous unobstructed outdoor illuminance is the correct definition.

Why the other options are wrong:

- Direct sunlight to diffuse skylight is a different quantity and DF deliberately uses a sunless overcast sky.
- Window area to floor area is the glazing ratio, not the daylight factor.
- Lamp output to room area concerns artificial lighting.

Final Answer: Indoor to simultaneous outdoor illuminance $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q26

Q27.

Solution

Concept – diversity factor in electrical load estimation: The connected load and the actual maximum demand of a building are not the same.

Step 1 – define the connected load: The connected load is the sum of the ratings of every appliance and point in the building.

Step 2 – explain why demand is lower: In practice, all these loads are never switched on at full power at the same instant, so the real maximum demand is smaller than the connected load.

Step 3 – state the factor: The diversity factor (≥ 1) accounts for this; dividing the connected load by the diversity factor (or multiplying by a demand factor) gives the maximum demand used to size mains and transformers, avoiding wasteful over-design.

Why the other options are wrong:

- If all loads did run together at full load, no diversity factor would be needed.
- Voltage variation and cable heating are separate effects, not the reason for the diversity factor.

Final Answer: Loads do not all run at full load together $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q27

Q28.

Solution

Concept – the ton of refrigeration: Cooling capacity in air-conditioning is often stated in tons of refrigeration.

Step 1 – recall the definition: One ton of refrigeration is the rate of heat removal needed to freeze one short ton (about 2000 lb) of water at $0°$C into ice in 24 hours.

Step 2 – give the equivalent in kW: Working this out, 1 TR $= 3.517$ kW ≈ 3.5 kW (equivalently about 12000 BTU/h).

Step 3 – match the option: The heat-removal rate of one TR is therefore about 3.5 kW.

Why the other options are wrong:

- 1.0 kW and 0.75 kW are far too small for one TR.
- 10 kW is close to about 3 TR, not one.

Final Answer: 3.5 kW $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q28

Q29.

Solution

Concept – conservation strategies for heritage buildings: Conservation offers several ways to keep an old building useful and protected.

Step 1 – read the description: The building is kept, its historic fabric and character are retained, and it is given a new, compatible present-day function.

Step 2 – name the strategy: Giving a heritage building a new, sympathetic use while conserving its fabric is **adaptive reuse** (for example a mill made into a museum, a palace into a hotel).

Step 3 – note the benefit: It keeps the building in active use, funds its upkeep and saves the embodied energy of demolition and rebuilding.

Why the other options are wrong:

- Demolition destroys the building, the opposite of conservation.
- Reconstruction rebuilds a lost structure, not the reuse of an existing one.
- Gentrification is a social/economic change of a neighbourhood, not a conservation technique.

Final Answer: Adaptive reuse $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q29

Q30.

Solution

Concept – international charters of conservation: Modern conservation practice rests on a set of agreed charters.

Step 1 – recall the 1964 charter: The International Charter for the Conservation and Restoration of Monuments and Sites, adopted at Venice in 1964, is the **Venice Charter**.

Step 2 – note its importance: It set out the guiding principles (minimum intervention, respect for original fabric, reversibility, clear distinction of new work) and led to the founding of ICOMOS.

Step 3 – match the option: The 1964 conservation charter is the Venice Charter.

Why the other options are wrong:

- The Athens Charter (1931, conservation; 1933, CIAM town planning) is earlier and different.
- The Nairobi Recommendation (1976) concerns historic areas but is not the 1964 charter.
- The Kyoto Protocol is an environmental treaty on greenhouse gases, unrelated to conservation.

Final Answer: Venice Charter $\Rightarrow$ $\boxed{C}$

Answer: (C) Go Back to Q30

Q31.

Solution

Concept – statutory protection of monuments in India: Different agencies look after different classes of built heritage.

Step 1 – identify the central body: Centrally protected monuments of national importance are looked after by the **Archaeological Survey of India (ASI)**, under the Ancient Monuments and Archaeological Sites and Remains (AMASR) Act.

Step 2 – note its work: The ASI declares, conserves and maintains these monuments and regulates construction in the prohibited and regulated zones around them.

Step 3 – match the option: The correct body is the Archaeological Survey of India.

Why the other options are wrong:

- CPWD builds and maintains government buildings, not protected monuments.
- TCPO is the central town-planning advisory body.
- NBO deals with housing and building statistics/research, not monument protection.

Final Answer: Archaeological Survey of India (ASI) $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q31

Q32.

Solution

Concept – what "listed building" means in heritage law: Listing is a legal instrument that recognises and protects heritage value.

Step 1 – define listing: A listed building is one placed on an official statutory register (a heritage list) because it is judged to be of special architectural or historic interest.

Step 2 – state the effect of listing: Once listed, the building is legally protected: it cannot be demolished, extended or altered in a way that harms its character without prior permission from the heritage authority.

Step 3 – match the option: Officially registered and legally protected against unregulated change is the correct meaning.

Why the other options are wrong:

- A real-estate sale listing has nothing to do with heritage status.
- Being the tallest in a precinct is irrelevant to listing.
- Age alone (more than ten years) does not make a building listed; it must have recognised special interest.

Final Answer: Statutorily registered and legally protected heritage building $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q32

Q33.

Solution

Concept – protecting the setting of a monument: A monument's value depends not only on itself but on the space around it.

Step 1 – describe the controlled area: Around a protected monument a belt of land is defined in which new development, building heights and activities are regulated (and, close in, prohibited).

Step 2 – name it: This regulated belt is the **buffer zone** (in Indian law, the prohibited and regulated areas around a centrally protected monument). It safeguards the visual setting and prevents encroachment.

Step 3 – match the option: The buffer (regulated) zone around the monument is correct.

Why the other options are wrong:

- A car parking zone is a use, not a protective control belt.
- A central business district is a commercial core, unrelated to monument protection.
- An agricultural green belt limits city sprawl, a different planning device.

Final Answer: Buffer (regulated) zone $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q33

Q34.

Solution

Concept – FAR and the number of floors: FAR caps the total floor area; the footprint fixes how that area stacks into storeys.

Step 1 – find the maximum total built-up area: Maximum built-up area = FAR $\times$ plot area $= 2.0 \times 800 = 1600$ m^2.

Step 2 – note the area per floor: Each floor covers a footprint of 320 m^2.

Step 3 – divide to get the number of floors: Number of floors $= \dfrac{1600}{320} = 5$.

Step 4 – state the result: A maximum of 5 equal floors can be built within the permitted FAR.

Why the other options are wrong:

- 2, 3 and 4 floors give only 640, 960 and 1280 m^2, less than the permitted 1600 m^2, so they do not use the full FAR.

Final Answer: 5 floors $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q34

Q35.

Solution

Concept – what a Master Plan is: The Master Plan is the central instrument of statutory town planning.

Step 1 – describe its nature: A Master Plan (or Development Plan) is a long-range, statutory document that guides the physical growth and land use of a city, typically over a horizon of about 20–25 years.

Step 2 – note its content: It fixes land-use zones, the road and transport network, densities, reservations for public uses and the development control regulations.

Step 3 – match the option: A long-range statutory land-use and growth document over 20–25 years is correct.

Why the other options are wrong:

- A working drawing for one building is at the scale of a single project.
- An annual budget is a finance document.
- A road-network-only map is just one layer of the plan, not the whole Master Plan.

Final Answer: Long-range statutory city development plan $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept – minimum dwelling size for EWS housing: Public housing schemes set a floor for the size of a dwelling.

Step 1 – recall the norm: For Economically Weaker Section (EWS) units under Indian schemes (such as PMAY), the minimum carpet area is of the order of $30\ \text{m}^2$.

Step 2 – note the intent: This ensures a basic liveable unit (a room, kitchen, bath and WC) even at the most affordable level; larger LIG units are bigger.

Step 3 – match the option: The order of $30\ \text{m}^2$ is correct.

Why the other options are wrong:

- 10 m^2 is far too small for a family dwelling.
- 100 m^2 and 200 m^2 are middle- and high-income sizes, well above the EWS minimum.

Final Answer: About $30 \text{ m}^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q36

Q37.

Solution

Concept – the planned city of Chandigarh: Chandigarh is India's best-known example of a fully planned modern city.

Step 1 – recall the planner: After the early scheme by Albert Mayer and Matthew Nowicki, the master plan was taken over and given its final form by **Le Corbusier** (with Pierre Jeanneret, Jane Drew and Maxwell Fry).

Step 2 – recall the sector idea: Le Corbusier organised the city into rectangular self-contained "sectors" of about $800 \text{ m} \times 1200 \text{ m}$, each with its own facilities, and a road hierarchy known as the 7 V's.

Step 3 – match the option: The sector-grid master plan of Chandigarh is Le Corbusier's.

Why the other options are wrong:

- Edwin Lutyens planned New Delhi, not Chandigarh.
- Otto Koenigsberger planned Bhubaneswar and worked on tropical housing, not Chandigarh's sector grid.
- Patrick Geddes was an earlier planner-biologist who did not plan Chandigarh.

Final Answer: Le Corbusier $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q37

Q38.

Solution

Concept – net residential density: Density is population divided by the land area it occupies.

Step 1 – write the formula: Net residential density $= \dfrac{\text{population}}{\text{net residential area}}$.

Step 2 – put in the values: $= \dfrac{12000 \text{ persons}}{40 \text{ ha}}$

Step 3 – divide: $= 300$ persons/ha

Step 4 – state the result: The net residential density is 300 persons per hectare.

Why the other options are wrong:

- 120 persons/ha would need an area of 100 ha.
- 480 persons/ha would need only 25 ha.
- 200 persons/ha would need 60 ha.

Final Answer: 300 persons/ha $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q38

Q39.

Solution

Concept – merged urban regions: As cities grow, neighbouring towns can physically join up.

Step 1 – describe the phenomenon: When several separately growing towns expand until their built-up areas run together into one continuous urban mass, they form a single extended settlement.

Step 2 – name it: Patrick Geddes coined the term **conurbation** for this merged urban region (for example the Greater London or Kolkata metropolitan agglomerations).

Step 3 – match the option: The merged, continuous urban region is a conurbation.

Why the other options are wrong:

- A green belt is open land kept around a city to limit its spread.
- A satellite town is a smaller, planned town near a large city but kept separate from it.
- Ribbon development is thin building growth strung along a highway, not a merged mass of towns.

Final Answer: Conurbation $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q39

Q40.

Solution

Concept – proximity operations in GIS: A GIS can analyse how near things are to a feature.

Step 1 – read the figure: A zone of fixed width has been drawn on both sides of the river line, shown as the shaded band around it.

Step 2 – name the operation: Creating such a zone of a given distance around a point, line or polygon is a **buffer** operation. A river buffer, for instance, marks the protection strip within which building may be restricted.

Step 3 – match the option: The operation shown is a buffer.

Why the other options are wrong:

- Georeferencing assigns real-world coordinates to a scanned map or image.
- Digitising is tracing features to convert them into vector data.
- Interpolation estimates values at unsampled points (as in making a surface), not a distance zone.

Final Answer: Buffer operation $\Rightarrow \boxed{\text{A}}$

$\boxed{\text{Answer: (A)}}$ Go Back to Q40

Q41.

Solution

Concept – reduced level from height of instrument: In the height-of-instrument method, a foresight is subtracted from the line of collimation.

Step 1 – write the relation: RL of point $=$ HI $-$ FS, where HI is the height of instrument (line of collimation) and FS is the foresight staff reading at that point.

Step 2 – put in the values: RL of P $= 102.500 - 1.750$

Step 3 – subtract: RL of P $= 100.750$ m

Step 4 – interpret: Because the foresight (1.750) is smaller than the backsight would need to be for a level line, point P lies below the instrument line by 1.750 m, giving RL $= 100.750$ m.

Why the other options are wrong:

- 104.250 m comes from adding the foresight instead of subtracting it.
- 102.500 m is the HI itself, not the RL of P.
- 1.750 m is just the staff reading.

Final Answer: 100.750 m $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q41

Q42.

Solution

Concept – arithmetic increase method of population forecasting: This method assumes the population grows by a constant *amount* each decade.

Step 1 – find the average decadal increase: Over two decades the population rose from 40000 to 60000, a rise of 20000; the average increase per decade is $\frac{20000}{2} = 10000$.

Step 2 – apply the constant increment: Under the arithmetic method the next decade adds the same amount again.

Step 3 – add to the latest census figure: Forecast $= 60000 + 10000 = 70000$.

Step 4 – state the result: The projected population one decade after the last census is 70000.

Why the other options are wrong:

- 60000 ignores any further growth.
- 65000 adds only half the decadal increment.
- 80000 adds two increments instead of one (that would be two decades ahead).

Final Answer: $70000 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q42

Q43.

Solution

Concept – reading distance from a map scale: The representative fraction relates map distance to ground distance.

Step 1 – interpret the RF: $1 : 25000$ means 1 unit on the map equals 25000 of the same units on the ground.

Step 2 – multiply the measured map distance: Ground distance $= 8$ cm $\times$ $25000 = 200000$ cm.

Step 3 – convert to metres: 200000 cm $= \frac{200000}{100} = 2000$ m.

Step 4 – convert to kilometres: 2000 m $= 2$ km.

Why the other options are wrong:

- 0.2 km and 200 km come from unit-conversion errors (factor of ten or of a thousand).
- 20 km is ten times too large.

Final Answer: 2 km $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q43

Q44.

Solution

Concept – the passenger car unit (PCU): Indian roads carry very mixed traffic, which must be brought to a common measure.

Step 1 – state the problem: Cars, two-wheelers, buses, trucks and cycles occupy different road space and move differently, so simply counting vehicles is misleading.

Step 2 – define the PCU: The passenger car unit converts each vehicle type into an equivalent number of standard passenger cars, using factors that reflect its size and effect on the stream (a car $= 1.0$, a two-wheeler < 1, a bus or truck > 1).

Step 3 – match the option: Converting a heterogeneous stream into an equivalent number of standard cars is the purpose of the PCU.

Why the other options are wrong:

- Counting passengers inside cars is occupancy, not PCU.
- Fuel consumption and fares have nothing to do with the PCU concept.

Final Answer: Convert mixed traffic into equivalent standard cars $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q44

Q45.

Solution

Concept – computing total volume in PCU: Multiply the count of each vehicle type by its PCU factor and add.

Step 1 – cars: $900 \times 1.0 = 900$ PCU.

Step 2 – two-wheelers: $200 \times 0.5 = 100$ PCU.

Step 3 – buses: $100 \times 3.0 = 300$ PCU.

Step 4 – add the three: $900 + 100 + 300 = 1300$ PCU per hour.

Step 5 – state the result: The total traffic volume is 1300 PCU/hour.

Why the other options are wrong:

- 1200 (all vehicles counted as 1.0) ignores the PCU factors $(900 + 200 + 100)$.
- 1000 drops the buses' extra weight.
- 1500 overstates the two-wheeler contribution (using 1.0 instead of 0.5).

Final Answer: 1300 PCU/hour $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q45

Q46.

Solution

Concept – the transverse slope of a road surface: A road surface is not perfectly flat across its width.

Step 1 – read the figure: The surface is highest at the crown in the middle and slopes down gently to both edges.

Step 2 – name it: This transverse (cross) slope from crown to edges is the **camber** (or cross-fall). Its purpose is to drain rainwater quickly off the carriageway to the side drains, keeping the surface dry and safe.

Step 3 – match the option: The crown-to-edges cross-slope is the camber.

Why the other options are wrong:

- Superelevation is the one-sided banking of the road *on a curve* to counter centrifugal force, not the two-sided drainage slope on a straight.
- A gradient is the slope *along* the length of the road, not across it.
- The right-of-way is the total width of land reserved for the road, not a slope.

Final Answer: Camber (cross-slope) $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q46

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	D	3	C	4	A	5	B
6	A	7	C	8	A	9	B	10	D
11	B	12	A	13	A	14	D	15	D
16	A	17	A	18	B	19	C	20	D
21	B	22	C	23	B	24	C	25	B
26	C	27	B	28	A	29	D	30	C
31	D	32	B	33	D	34	D	35	C
36	B	37	D	38	D	39	A	40	A
41	B	42	C	43	C	44	A	45	B
46	A								