MAH M Arch CET Settlement Design and Planning

Sample Paper – 1

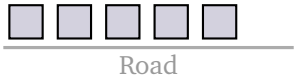
Total Questions	Total Marks	Duration	Exam Mode
10	20	12 Minutes	CBT (Online)

Instructions

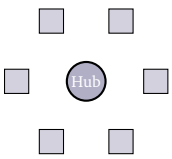
- This paper contains 10 Multiple Choice Questions (Single Correct Answer), modelled on the Settlement Design and Planning portion of MAH M Arch CET entrance.
- Each correct answer carries +2 marks. There is no negative marking for incorrect or unattempted answers.
- Only one option is correct. Choose carefully.
- Syllabus: Settlement patterns, urban planning, housing typologies, land use, transport, government schemes, and planning standards.
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Section D | Settlement Design and Planning | 10 Questions × 2 Marks = 20 Marks

Q1. Study the two rural settlement patterns shown below. Which of the following statements correctly describes the condition under which a **nucleated** settlement form typically develops?



Pattern I: Linear



Pattern II: Nucleated

(A) Linear settlements arise from the convergence of multiple roads at a central node, creating dense clustering around that point.

(B) Nucleated settlements form where a central resource — such as a water source, market, or religious site — attracts community clustering.

(C) Linear settlement is exclusive to hilly terrain and river valleys and does not occur in plains.

(D) Nucleated settlements are found only in fertile plains with surplus agricultural land and do not occur in other terrain types.

Q2. According to **Christaller's Central Place Theory**, the hexagonal market areas result from which fundamental spatial principle?

(A) Hexagonal shapes arise naturally from topographic barriers such as rivers and mountain ranges that restrict circular market areas.

(B) Hexagons are a regulatory planning imposition to rationalise land use boundaries between competing urban centres.

(C) Each central place commands the largest possible non-overlapping tributary area when central places of the same order are evenly spaced, creating hexagonal hinterlands.

(D) The hexagonal pattern reflects the minimum spanning tree of road networks connecting central places of equal order.

Q3. Which of the following activities is classified under the **'Industrial Use Zone' (I-Zone)** in a typical Indian Master Plan and is therefore **NOT** permissible within a 'Residential Use Zone' (R-Zone)?

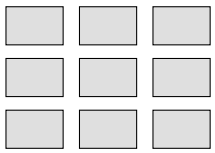
(A) A medium-scale manufacturing unit producing plastic goods using power-operated machinery.

(B) A neighbourhood grocery shop serving the local residential population.

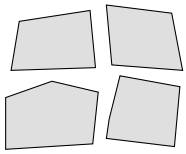
(C) A primary school catering to children of the surrounding residential colony.

(D) A private clinic with fewer than 10 beds providing outpatient services to local residents.

Q4. The figure below shows two urban street layout patterns. Which statement correctly identifies an **advantage of the organic (Pattern B)** layout over the grid-iron (Pattern A) layout?



Pattern A: Grid-iron



Pattern B: Organic

(A) Grid-iron patterns are inherently more adaptable to hilly or irregular terrain than organic layouts.

(B) Organic layouts are cheaper and simpler to survey, subdivide, and legally describe than grid layouts.

(C) Grid-iron patterns inherently provide greater visual variety and a stronger sense of enclosure for pedestrians.

(D) Organic street patterns naturally discourage high-speed through-traffic, thereby enhancing pedestrian safety in residential neighbourhoods.

Q5. Row housing (terraced housing) is preferred over detached bungalow typology in high-density urban areas **primarily** because:

(A) Shared party walls on both sides eliminate two external wall surfaces per unit, significantly reducing heat gain/loss and land consumption per unit.

(B) Row housing always provides individual private gardens of area equivalent to those of standalone bungalow plots.

(C) Row housing can be constructed to unlimited heights without any structural modifications or special structural approvals.

(D) Detached bungalows mandatorily require a 6 m setback on all four sides, while row housing has absolutely no setback requirements.

Q6. In the Indian road classification system for urban areas (as per IRC and UDPFI guidelines), which road category is specifically designed to **connect residential neighbourhoods to the arterial road network**, with a right-of-way typically between **18 m and 24 m**?

(A) National highway passing through an urban area.
(B) Collector / sub-arterial street.
(C) Local street / cul-de-sac.
(D) Expressway / ring road (grade-separated).

Q7. The **Smart Cities Mission (SCM)**, launched by the Government of India in 2015, selects cities through a competitive 'City Challenge' process. Which of the following is the **primary mechanism** of urban improvement proposed under SCM?

(A) Providing 100% piped water supply to all urban local bodies in India by 2022.
(B) Upgrading all peri-urban villages within 5 km of a city boundary to municipal corporation status.
(C) Building 20 million new affordable housing units in tier-1 and tier-2 cities.
(D) Development of an Area Based Development (ABD) model in a selected inner-city core or greenfield extension, combined with a Pan-City initiative leveraging smart technology.

Q8. Which of the following statements about a **Statutory Master Plan** (Development Plan) prepared under State Town and Country Planning Acts in India is **CORRECT**?

(A) A Master Plan is only an indicative, advisory document and carries no legal force for private property owners.
(B) The plan period for Indian Master Plans is mandated by the Constitution to be exactly 5 years, aligned with the Five-Year Plan cycle.
(C) A Master Plan is a statutory legal document, typically prepared for a 20-year horizon, and is binding on both public agencies and private developers regarding land use and development.

(D) Master Plans are prepared exclusively for metropolitan areas with a population above 10 lakh and are not applicable to smaller towns.

Q9. A plot of **500 m^2** in a commercial zone has a permissible **Floor Area Ratio (FAR) of 3.0** and a maximum **ground coverage of 60%**. What is the **maximum permissible total built-up area** across all floors on this plot?

(A) 900 m^2
(B) 1500 m^2
(C) 300 m^2
(D) 1800 m^2

Q10. As per the **CPHEEO** (Central Public Health and Environmental Engineering Organisation) Manual, the recommended per capita water supply for a **Class-I city** (population above 1 lakh) **with full sewerage** is:

(A) 135 litres per capita per day (lpcd)
(B) 70 lpcd
(C) 200 lpcd
(D) 40 lpcd

Detailed Solutions

Sol. 1.

Solution

Difficulty: Beginner • Chapter: Settlement Morphology

Quick Solution: Nucleated settlements arise around a focal point of attraction such as a water source, market, or place of worship. **Answer: (B).**

Concept — Settlement Morphology: Settlements are classified by their spatial form and the factor driving their layout. A **linear settlement** develops when dwellings string along a dominant linear feature — a road, river, canal, railway, or valley floor — because residents seek proximity to that route, not necessarily to each other. Buildings front the route and extend in both directions, producing a ribbon plan. A **nucleated settlement** develops when a focal point of attraction — a perennial water source, periodic market, temple, church, or defensive hilltop — draws people to cluster around it, producing a compact, roughly circular or radiating plan with the resource at its core.

Analysis of each option:

- **(A) Linear settlements arise from convergence of roads at a central node**: Incorrect. Convergence of roads at a single node creates a central point of attraction which is precisely what generates a *nucleated* settlement, not a linear one. Linear settlements arise from development *along* a single route.
- **(B) Nucleated settlements form around a central resource**: Correct. A shared resource — water well, market, place of worship — acts as the gravitational centre around which the community clusters, producing the characteristic compact nucleated form.
- **(C) Linear settlement is exclusive to hilly terrain**: Incorrect. Linear settlements form wherever a road, river, canal, or valley provides a linear axis for development, including flat plains, coastal strips, and valley floors.
- **(D) Nucleated settlements only in fertile plains with surplus agricultural land**: Incorrect. Nucleated settlements occur wherever a central resource or historic defensive advantage exists — in uplands, semi-arid zones, and plains alike; terrain or agricultural productivity is not the determining factor.

Final Answer: Nucleated settlement forms where a central resource attracts clustering $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q1

Sol. 2.

Solution

Difficulty: Intermediate • Chapter: Urban Theory and Settlement Hierarchy

Quick Solution: Hexagonal hinterlands emerge because evenly-spaced same-order centres generate the largest possible non-overlapping tributary areas. **Answer: (C).**

Concept — Christaller's Central Place Theory (1933): Walter Christaller proposed that on a uniform, featureless plain with even population distribution and equal purchasing power, settlements of equal hierarchical order ("central places") would space themselves equidistantly to maximise their market areas. Theoretically, each central place's market area would be circular; but adjacent circles either leave uncovered triangular areas (wasteful) or overlap (economically irrational). The geometric solution is hexagons — the most efficient tessellation that eliminates both overlap and uncovered space. This produces a nested hexagonal hierarchy governed by the marketing principle (K=3), transport principle (K=4), or administrative principle (K=7).

Analysis of each option:

- **(A) Hexagons arise from topographic barriers**: Incorrect. Topographic barriers *distort* hexagonal patterns. The theory explicitly assumes a uniform, barrier-free plain. Barriers are specifically excluded from the theoretical model.
- **(B) Hexagons are a regulatory planning imposition**: Incorrect. Hexagons emerge from spatial economic logic — they are not imposed by governments or planning authorities but arise naturally from the geometry of non-overlapping circular market areas.
- **(C) Largest possible non-overlapping tributary area for evenly-spaced centres**: Correct. This is the precise geometric and economic rationale at the core of the theory.
- **(D) Hexagonal pattern reflects minimum spanning tree of road networks**: Incorrect. Minimum spanning tree algorithms produce branching, dendritic (tree-like) network structures, not closed hexagonal polygons.

Final Answer: Equal spacing → maximum non-overlapping hexagonal hinterlands ⇒ C

Answer: (C) Go Back to Q2

Sol. 3.

Solution

Difficulty: Beginner • Chapter: Land Use Planning and Zoning

Quick Solution: Power-operated manufacturing is an industrial activity strictly excluded from the Residential Zone. **Answer: (A).**

Concept — Land Use Zoning in Indian Master Plans: Under the UDPFI Guidelines and most State Town Planning Acts, land in a Master Plan is divided into Use Zones: Residential (R), Commercial (C), Industrial (I), Public and Semi-Public (PSP), Recreational (G), and Transportation (T). The **Industrial Zone (I-Zone)** covers manufacturing, processing, warehousing, and allied industrial activities that generate noise, vibration, air pollution, heavy vehicle traffic, and safety hazards incompatible with residential living. The **Residential Zone (R-Zone)** permits dwellings and low-intensity compatible uses: local convenience shops, schools, clinics, places of worship, and community facilities that serve the resident population without nuisance impacts.

Analysis of each option:

- **(A) Medium-scale plastic goods manufacturing with power-operated machinery**: Correct. This is squarely an industrial activity involving machinery noise, pollution risk, and heavy raw material/finished goods movement. It is classified under I-Zone and is not permissible in R-Zone.
- **(B) Neighbourhood grocery shop**: Incorrect. Local shops serving the day-to-day needs of residents are permissible in R-Zone as compatible convenience commerce with negligible nuisance.
- **(C) Primary school**: Incorrect. Educational institutions serving local children are treated as essential residential amenities and are explicitly permitted in R-Zone under most Indian planning bylaws.
- **(D) Private clinic with fewer than 10 beds**: Incorrect. Small clinics, dispensaries, and nursing homes below the threshold bed count are classified as local health amenities compatible with residential character and generally permitted in R-Zone.

Final Answer: Industrial manufacturing belongs in I-Zone, not R-Zone $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q3

Sol. 4.

Solution

Difficulty: Intermediate • Chapter: Urban Form and Street Patterns

Quick Solution: Organic/irregular streets geometrically discourage high vehicle speeds, improving pedestrian safety. **Answer: (D).**

Concept — Grid-iron vs. Organic Street Patterns: The **grid-iron** layout (regular rectangular blocks) offers ease of navigation, simple land subdivision, efficient utility routing, and predictable block sizes. However, long straight streets invite high vehicle speeds and allow through-traffic to penetrate deep into residential interiors, creating safety hazards for pedestrians and cyclists. The **organic/irregular** layout, arising historically from topographic constraints or incremental growth, features curved streets, offset intersections, and varying block sizes. These geometric irregularities act as passive traffic calming — drivers cannot maintain speed through bends and awkward junctions, naturally reducing speeds and discouraging non-local through-traffic from using residential streets.

Analysis of each option:

- **(A) Grid-iron is more adaptable to hilly terrain**: Incorrect. Organic layouts evolved precisely to follow natural contours, varying street gradients and block orientations with topography. Grids imposed on steep terrain produce impractical grades and require costly cut-and-fill operations.
- **(B) Organic patterns cheaper to survey and subdivide**: Incorrect. Regular grids with right-angle geometry are far simpler, faster, and cheaper to survey, subdivide, and describe legally by metes and bounds. Organic layouts require complex surveying of irregular plot boundaries.
- **(C) Grid-iron provides greater visual variety**: Incorrect. Uniform repetitive grid streets tend towards visual monotony; organic patterns with their varied widths, unexpected bends, and changing vistas offer richer pedestrian visual experience and sense of enclosure.
- **(D) Organic patterns discourage high-speed through-traffic**: Correct. Geometric irregularity is a well-documented passive traffic calming mechanism that reduces vehicle speeds and enhances pedestrian safety in residential areas.

Final Answer: Organic streets use geometric friction to naturally slow traffic $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q4

Sol. 5.

Solution

Difficulty: Beginner • Chapter: Housing Typology

Quick Solution: Shared party walls reduce exposed external surface area, cutting thermal load and land consumed per unit. **Answer: (A).**

Concept — Row Housing (Terraced Housing): Row or terraced housing arranges dwelling units side by side in a continuous terrace, sharing **party walls** between adjacent units. Each intermediate unit in the row has only **two exposed external walls** (front and rear), compared to four for a detached bungalow. This has two major structural advantages in high-density urban contexts:

(a) **Thermal efficiency**: Two fewer exposed surfaces significantly reduce heat gain in summer and heat loss in winter, lowering energy loads for cooling and heating.
(b) **Land efficiency**: Shared walls eliminate the mandatory side setbacks required between detached structures, allowing substantially more dwelling units per hectare at significantly lower land cost per unit.

Analysis of each option:

- **(A) Shared party walls reduce exposure and land consumption per unit**: Correct. This is the primary structural, thermal, and economic rationale for the typology's widespread adoption in dense urban areas.
- **(B) Row housing provides equivalent private garden area to bungalows**: Incorrect. Row housing typically offers much smaller rear gardens or no private open space at all; it is precisely this trade-off that enables higher densities.
- **(C) Row housing can reach unlimited heights**: Incorrect. Row/terraced housing is inherently a low-rise typology, typically limited to 2–4 storeys. Greater heights require entirely different structural systems (e.g., reinforced concrete frames for slab blocks or point towers).
- **(D) Detached bungalows have mandatory 6 m setbacks on all sides; row housing has none**: Incorrect. Setback requirements for both typologies vary by zone, plot size, and local development bylaws. The claim that row housing has absolutely no setback requirements is an incorrect generalisation — front and rear setbacks typically still apply.

Final Answer: Shared party walls $\rightarrow$ less exposure $+$ less land per unit $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q5

Sol. 6.

Solution

Difficulty: Intermediate • Chapter: Transportation Planning

Quick Solution: The collector/sub-arterial street (ROW 18–24 m) is designed to link residential neighbourhoods to arterial roads. **Answer: (B).**

Concept — Urban Road Hierarchy (IRC/UDPFI Guidelines): Indian urban roads are organised in a four-level functional hierarchy, each tier characterised by right-of-way (ROW), design speed, and access function:

Road Type	Typical ROW	Function
Expressway / Ring Road	>60 m	Grade-separated; inter-city / metro movement
Arterial Road	30–45 m	Major city-level movement corridors
Sub-arterial / Collector	18–24 m	Neighbourhood to arterial linkage
Local Street	9–12 m	Access within a neighbourhood block

The **collector/sub-arterial street** is the critical intermediate link — it aggregates traffic from local streets within residential areas and feeds it into the arterial network.

Analysis of each option:

- **(A) National highway through an urban area**: Incorrect. National highway ROW typically exceeds 45 m; it serves inter-city movement, not neighbourhood-to-arterial connectivity.
- **(B) Collector / sub-arterial street**: Correct. ROW 18–24 m; specifically designed to connect residential and commercial neighbourhoods to the arterial network with limited direct property access.
- **(C) Local street / cul-de-sac**: Incorrect. Local streets have ROW of only 9–12 m and serve direct access to individual plots within a residential block.
- **(D) Expressway / ring road**: Incorrect. Grade-separated expressways have ROW exceeding 60 m; they serve regional/metropolitan movement with no direct property or local access.

Final Answer: Collector/sub-arterial street (18–24 m ROW) links neighbourhoods to arterials $\Rightarrow$ B

Answer: (B) Go Back to Q6

Sol. 7.

Solution

Difficulty: Beginner • Chapter: Urban Development Schemes (Government of India)

Quick Solution: SCM's primary mechanism is Area Based Development (ABD) in a selected zone combined with a Pan-City smart technology initiative. **Answer: (D).**

Concept — Smart Cities Mission (SCM), 2015: Launched by the Ministry of Housing and Urban Affairs in June 2015, SCM targets 100 selected cities chosen through competitive challenge rounds. Its operational framework rests on two complementary pillars:

- **Area Based Development (ABD)**: A defined geographic pocket within the city is transformed through one of three models — *retrofitting* (upgrading infrastructure in a built-up area), *redevelopment* (replacing existing built environment), or *greenfield development* (new development on vacant land). This area becomes the model smart zone.
- **Pan-City Solution**: Smart/ICT-based solutions are applied city-wide — examples include intelligent traffic signal management, e-governance portals, smart street lighting, integrated command and control centres (ICCCs), and sensor-based utility monitoring.

This dual mechanism distinguishes SCM from other urban schemes.

Analysis of each option:

- **(A) 100% piped water supply to all ULBs by 2022**: Incorrect. This is the mandate of **AMRUT** (Atal Mission for Rejuvenation and Urban Transformation), not SCM.
- **(B) Upgrading peri-urban villages to municipal corporation status**: Incorrect. SCM does not alter municipal boundaries, governance classification, or jurisdictional limits of surrounding rural areas.
- **(C) Building 20 million affordable housing units**: Incorrect. Affordable housing construction is the mandate of **PMAY-Urban** (Pradhan Mantri Awas Yojana — Urban).
- **(D) ABD model + Pan-City smart initiative**: Correct. This is the defining two-pronged operational structure of the Smart Cities Mission.

Final Answer: SCM = Area Based Development + Pan-City smart initiative $\Rightarrow$ D

Answer: (D) Go Back to Q7

Sol. 8.

Solution

Difficulty: Beginner • Chapter: Urban Planning Legislation in India

Quick Solution: Master Plans are statutory, legally notified documents prepared for a 20-year horizon, binding on both public and private stakeholders. **Answer: (C).**

Concept — Statutory Master Plan (Development Plan): Under State Town and Country Planning Acts (e.g., Maharashtra Regional and Town Planning Act 1966, Delhi Development Act 1957, Karnataka Town and Country Planning Act 1961), the **Master Plan** is a legally sanctioned instrument. Once notified in the Official Gazette, it acquires statutory force, making its land use designations, development controls (FAR, height limits, ground coverage), and infrastructure proposals legally binding on public authorities *and* private landowners and developers. Violations can be challenged and penalised. The standard planning horizon is **20 years**, with provisions for review and revision. The plan is prepared by the development authority or local body with mandatory public participation and State Government sanction.

Analysis of each option:

- **(A) Only indicative and advisory; no legal force for private owners**: Incorrect. A *statutory* Master Plan, once formally notified, carries full legal force under the relevant State Act. It is not merely a policy guide — violations are legally actionable.
- **(B) Plan period mandated by Constitution to be 5 years**: Incorrect. The Constitution does not prescribe plan periods for Master Plans. The standard horizon of 20 years is set by State Acts and planning practice, not constitutionally mandated, and is unrelated to the Five-Year Plan cycle.
- **(C) Statutory 20-year legal document, binding on public and private**: Correct. This accurately describes the legal character of a notified Master Plan under Indian planning law.
- **(D) Only for metropolitan areas with population above 10 lakh**: Incorrect. Many State Town Planning Acts mandate Master Plans for urban local bodies across a range of population thresholds, including medium and small towns well below 10 lakh.

Final Answer: Statutory, 20-year legal document binding on all stakeholders $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q8

Sol. 9.

Solution

Difficulty: Beginner • Chapter: Development Controls and Regulations

Quick Solution: FAR $\times$ Plot Area $= 3.0 \times 500 = 1500\,\text{m}^2$. **Answer: (B).**

Concept — Floor Area Ratio (FAR) / Floor Space Index (FSI): FAR (also called FSI in Maharashtra) is defined as:

$$\text{FAR} = \frac{\text{Total Built-up Area across all floors}}{\text{Plot Area}}$$

Therefore:

$$\text{Maximum Total Built-up Area} = \text{FAR} \times \text{Plot Area} = 3.0 \times 500\,\text{m}^2 = \mathbf{1500\,m^2}$$

The **ground coverage** constraint ($60\% \times 500 = 300\,\text{m}^2$) limits the maximum footprint of any single floor. With a $300\,\text{m}^2$ footprint, the FAR of 3.0 permits up to $1500 \div 300 = 5$ storeys. However, the question asks specifically for *maximum total built-up area*, which is directly given by FAR $\times$ plot area, independent of how many floors are used.

Analysis of each option:

- **(A) 900 m^2**: Incorrect. A common error: the solver mistakenly applies FAR to the ground coverage area ($300\,\text{m}^2 \times 3 = 900\,\text{m}^2$) rather than to the full plot area.
- **(B) 1500 m^2**: Correct. FAR $\times$ Plot Area $= 3.0 \times 500 = 1500\,\text{m}^2$.
- **(C) 300 m^2**: Incorrect. This is only the maximum permissible ground coverage ($60\% \times 500 = 300\,\text{m}^2$) — the footprint of a single floor, not the total built-up area across all floors.
- **(D) 1800 m^2**: Incorrect. This would require a FAR of $1800 \div 500 = 3.6$, which exceeds the permissible FAR of 3.0.

Final Answer: FAR $\times$ Plot Area $= 3.0 \times 500 = 1500\,\text{m}^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q9

Sol. 10.

Solution

Difficulty: Beginner • Chapter: Infrastructure and Services Planning

Quick Solution: CPHEEO recommends 135 lpcd for Class-I cities with full sewerage — the standard benchmark used in all Indian planning practice. **Answer: (A).**

Concept — CPHEEO Per Capita Water Supply Norms: The CPHEEO (Central Public Health and Environmental Engineering Organisation) Manual on Water Supply, published by the Government of India, prescribes per capita water supply norms by city class and service level:

City/Town Category	Per Capita Supply
Class-I cities (>1 lakh population) with full sewerage	**135 lpcd**
Towns without sewerage	70 lpcd
Metropolitan areas (higher-end estimate)	up to 150 lpcd
Emergency / un-serviced areas (survival minimum)	40 lpcd

The **135 lpcd** figure is the consistent benchmark used in planning standards, state government documents, and entrance examinations for Class-I cities with sewered systems.

Analysis of each option:

- **(A) 135 lpcd**: Correct. Standard CPHEEO norm for Class-I cities (population >1 lakh) with full sewerage infrastructure.
- **(B) 70 lpcd**: Incorrect. This norm applies to small towns or settlements without sewerage systems, where water demand is lower due to absence of water-borne sanitation.
- **(C) 200 lpcd**: Incorrect. This figure exceeds the CPHEEO Class-I benchmark. While higher estimates exist for premium metropolitan contexts in some interpretations, 200 lpcd is not the standard Class-I reference value in the CPHEEO Manual.
- **(D) 40 lpcd**: Incorrect. This is the emergency survival minimum prescribed for un-serviced or disaster-affected areas — far below the Class-I city standard for a normally functioning urban water supply system.

Final Answer: CPHEEO Class-I city norm (with full sewerage) $= 135$ lpcd $\Rightarrow$ A

Answer: (A) Go Back to Q10

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	D	5	A
6	B	7	D	8	C	9	B	10	A