QUESTION BANK

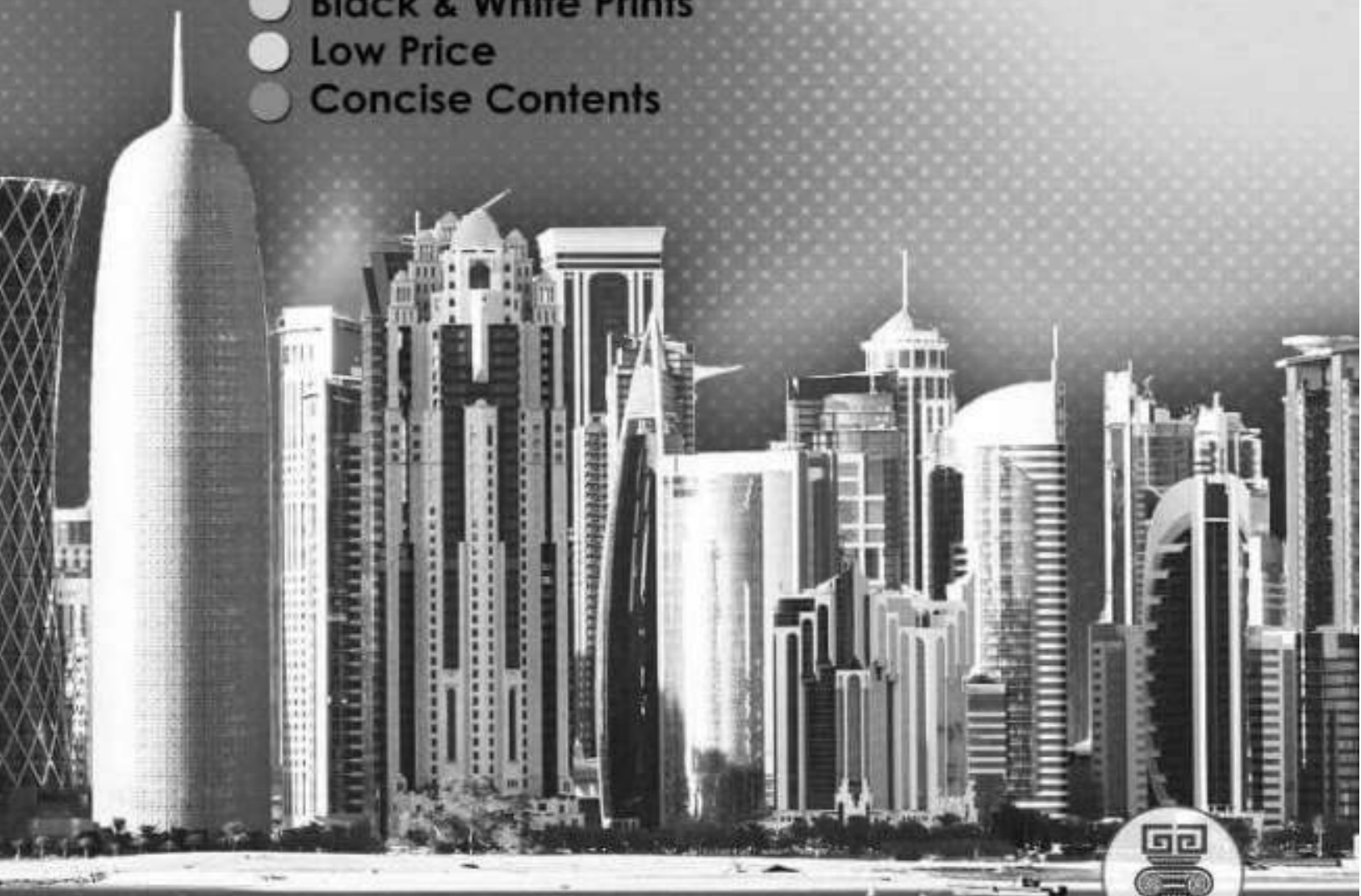
COMPLETE
28
YEARS

2018-1991

By
Faculty of Architecture

Economy Edition

- Black & White Prints
- Low Price
- Concise Contents



GATE ARCHITECTURE

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GATE QUESTION BANK

[ARCHITECTURE & PLANNING]

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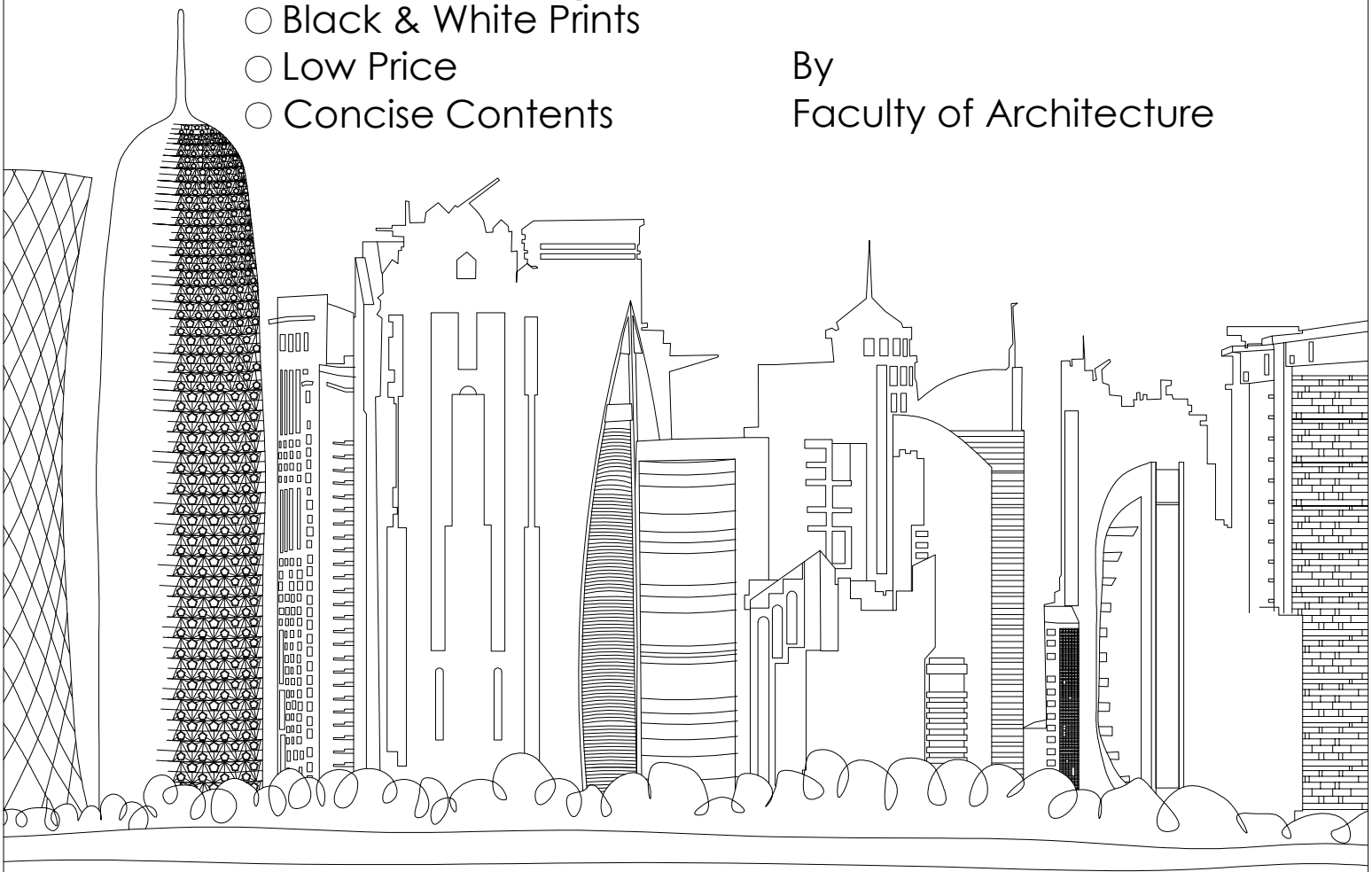

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Quote"

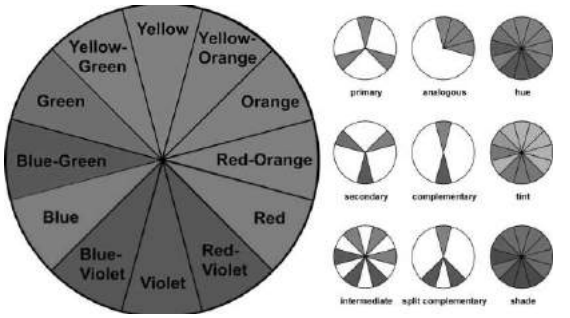
"The interesting observation is to try to work with people but even more than that to try to make them successful. If you try to make others successful, they, in turn, will try to make you successful. No matter how brilliant you are, no matter how good you are, no matter how hard you work, if you rely only on yourself and believe you don't need the help of others, you are sadly mistaken. If you engage everybody around you by helping them, they will help you, in turn. And you will be more successful than you ever dreamed of." – Former director Goldman Sachs

Contents

Introduction

This is the Economy Edition. The best part of this book is that it is comprehensive yet concise. It is a Black & White printed book. **The main problem** of any Black & White printed book is that the image or photograph loses most of its information.

Few examples are given below:

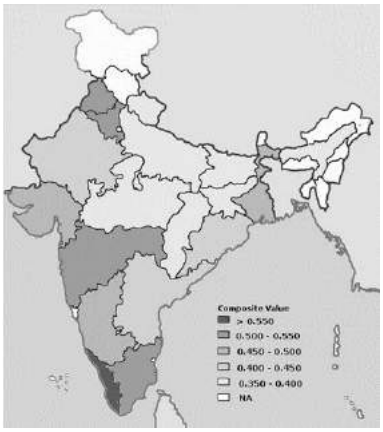


The color wheel: Perception of color is lost.

Land Use code: Vital information is lost

Cassia fistula: Hard to recognize.

Traffic sign: Low contrast



HDI Index: Painful to read

The Shodhan House, Ahmedabad: Building Photograph always loses details.

We have solution.

Last pages of this book have color images of Graphs, Illustrations, Photographs, Buildings, Snapshots etc. All these will greatly enhance your understanding about the subject.

The best way to prepare for an exam like GATE is through comprehensive study of previous year question papers. It take less time to cover most part of the syllabus. Solving the previous year's GATE questions help aspirants to understand the exam pattern, knowing the level of questions and predict the pattern. At the same time you may be aware that just knowing the answers of previous year question paper is just not enough.

For example if the question is: The teahouse is a feature of which type of landscape architecture? And you learnt that the answer 'Japanese Garden'. It is best to support the answer with addition notes & figures about different types of gardens i.e. French, English, and Chinese etc. One reason for providing such notes is that it is rarely possible that in the next few years, the same question will be repeated. But it is quite possible that if a question is asked form related topic, you should answer it if you have gone through addition studies or notes.

Providing answer with essential notes & explanation is the main features of this Question Bank. It's been tried to cover the maximum part of the syllabus through providing supportive notes.

This question bank contains question papers of last 28 years from 1991 to 2018. All it makes it the complete question bank. When you go through all these, you will get an idea how question pattern and trend has changed over time. This will greatly help you to focus on the part of the syllabus which are frequently asked in exams.

This book should provide an edge to your study. Hopeful that it will make you confident and feel easy on question pattern. Best wishes for your preparation.

GATE SYLLABUS 2019

Section 1: Architecture and Design Visual composition in 2D and 3D; Principles of Art and Architecture; Organization of space; Architectural Graphics; Computer Graphics– concepts of CAD, BIM, 3D modeling and Architectural rendition; Programming languages and automation. Anthropometrics; Planning and design considerations for different building types; Site planning; Circulation- horizontal and vertical; Barrier free design; Space Standards; Building Codes; National Building Code.

Elements, construction, architectural styles and examples of different periods of Indian and Western History of Architecture; Oriental, Vernacular and Traditional architecture; Architectural developments since Industrial Revolution; Influence of modern art on architecture; Art nouveau, Eclecticism, International styles, Post Modernism, Deconstruction in architecture; Recent trends in Contemporary Architecture; Works of renowned national and international architects.

Section 2: Building Materials, Construction and Management Behavioral characteristics and applications of different building materials viz. mud, timber, bamboo, brick, concrete, steel, glass, FRP, AAC, different polymers, composites.

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Estimation, specification, valuation, professional practice; Construction planning and equipments; Project management techniques e.g. PERT, CPM etc.

Section 3: Building and Structures Principles of strength of materials; Design of structural elements in wood, steel and RCC; Elastic and Limit State design; Structural systems in RCC and Steel; Form and Structure; Principles of Pre-stressing; High Rise and Long Span structures, gravity and lateral load resisting systems; Principles and design of disaster resistant structures.

Section 4: Environmental Planning and Design Ecosystem- natural and man-made ecosystem; Ecological principles; Concepts of Environmental Impact Analysis; Environmental considerations in planning and design; Thermal comfort, ventilation and air movement; Principles of lighting and illumination; Climate responsive design; Solar architecture; Principles of architectural acoustics; Green Building- Concepts and Rating; ECBC; Building Performance Simulation and Evaluation; Environmental pollution- types, causes, controls and abatement strategies.

Section 5: Urban Design Concepts and theories of urban design; Public Perception; Townscape; Public Realm; Urban design interventions for sustainable development and transportation; Historical and modern examples of urban design; Public spaces, character, spatial qualities and Sense of Place; Elements of urban built environment – urban form, spaces, structure, pattern, fabric, texture, grain etc; Principles, tools and techniques of urban design; Urban renewal and conservation; Site planning; Landscape design; Development controls – FAR, densities and building byelaws.

Section 6: Urban Planning and Housing Planning process; Types of plans - Master Plan, City Development Plan, Structure Plan, Zonal Plan, Action Area Plan, Town Planning Scheme, Regional Plan; Salient concepts, theories and principles of urban planning; Sustainable urban development; Emerging concepts of cities - Eco-City, Smart City, Transit Oriented Development (TOD), SEZ, SRZ etc.

Housing; Concepts, principles and examples of neighbourhood; Housing typologies; Slums; Affordable Housing; Housing for special areas and needs; Residential densities; Standards for housing and community facilities; National Housing Policies, Programs and Schemes.

Section 7: Planning Techniques and Management Tools and techniques of Surveys – Physical, Topographical, Landuse and Socio-economic Surveys; Methods of non-spatial and spatial data analysis; Graphic presentation of spatial data; Application of G.I.S and Remote Sensing techniques in urban and regional planning; Decision support system and Land Information System.

Urban Economics; Law of demand and supply of land and its use in planning; Social, Economical and environmental cost benefit analysis; Techniques of financial appraisal; Management of Infrastructure Projects; Development guidelines such as URDPFI; Planning Legislation and implementation – Land Acquisition Act, PPP etc.; Local self-governance.

Section 8: Services, Infrastructure and Transportation Building Services: Water supply; Sewerage and drainage systems; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system; Principles of electrification of buildings; Intelligent Buildings; Elevators and Escalators - standards and uses; Air-Conditioning systems; Firefighting Systems; Building Safety and Security systems.
Urban Infrastructure – Transportation, Water Supply, Sewerage, Drainage, Solid Waste Management, Electricity and Communications.
Process and Principles of Transportation Planning and Traffic Engineering; Road capacity; Traffic survey methods; Traffic flow characteristics; Traffic analyses and design considerations; Travel demand forecasting; Land-use – transportation - urban form inter-relationships; Design of roads, intersections, grade separators and parking areas; Hierarchy of roads and level of service; Traffic and transport management and control in urban areas,; Mass transportation planning; Para-transits and other modes of transportation, Pedestrian and slow moving traffic planning; Intelligent Transportation Systems.
Principles of water supply and sanitation systems; water treatment; Water supply and distribution system; Water harvesting systems; Principles, Planning and Design of storm water drainage system; Sewage disposal methods; Methods of solid waste management - collection, transportation and disposal; Recycling and Reuse of solid waste; Power Supply and Communication Systems, network, design and guidelines. **General Aptitude**

Q. 1 – Q. 5 carry one mark each.

Q.1 "When she fell down the _____, she received many _____ but little help." The words that best fill the blanks in the above sentence are
(A) stairs, stares (B) stairs, stairs (C) stares, stairs (D) stares, stares

Q.2 "In spite of being warned repeatedly, he failed to correct his _____ behavior." The word that best fills the blank in the above sentence is
(A) rational (B) reasonable (C) errant (D) good

Q.3 For $0 \leq x \leq 2\pi$, sin x and cos x are both decreasing functions in the interval
(A) $(0, \pi/2)$ (B) $(\pi/2\ ,\ \pi)$ (C) $(\pi, 3\pi/2)$ (D) $(3\pi/2\ ,\ 2\pi)$

Q.4 The area of an equilateral triangle is $\sqrt{3}$. What is the perimeter of the triangle?
(A) 2 (B) 4 (C) 6 (D) 8

Q.5 Arrange the following three-dimensional objects in the descending order of their volumes:
(i) A cuboid with dimensions 10 cm, 8 cm and 6 cm
(ii) A cube of side 8 cm
(iii) A cylinder with base radius 7 cm and height 7 cm
(iv) A sphere of radius 7 cm

(A) (i), (ii), (iii), (iv) (B) (ii), (i), (iv), (iii) (C) (iii), (ii), (i), (iv) (D) (iv), (iii), (ii), (i)

Q. 6 – Q. 10 carry two marks each.

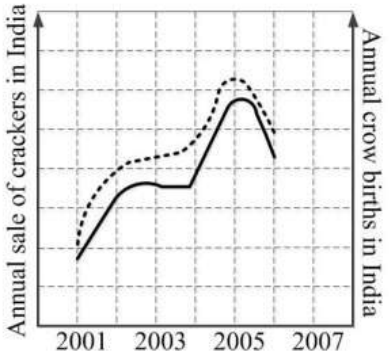
Q.6 An automobile travels from city A to city B and returns to city A by the same route. The speed of the vehicle during the onward and return journeys were constant at 60 km/h and 90 km/h, respectively. What is the average speed in km/h for the entire journey?
(A) 72 (B) 73 (C) 74 (D) 75

Q.7 A set of 4 parallel lines intersect with another set of 5 parallel lines. How many parallelograms are formed?
(A) 20 (B) 48 (C) 60 (D) 72

Q.8 To pass a test, a candidate needs to answer at least 2 out of 3 questions correctly. A total of 6,30,000 candidates appeared for the test. Question A was correctly answered by 3,30,000 candidates. Question B was answered correctly by 2,50,000 candidates. Question C was answered correctly by 2,60,000 candidates. Both questions A and B were answered correctly by 1,00,000 candidates. Both questions B and C were answered correctly by 90,000 candidates. Both questions A and C were answered correctly by 80,000 candidates. If the number of students answering all questions correctly is the same as the number answering none, how many candidates failed to clear the test?
(A) 30,000 (B) 2,70,000 (C) 3,90,000 (D) 4,20,000

Q.9 If $x2 + x - 1 = 0$ what is the value of $x4 + 1/x4$?
(A) 1 (B) 5 (C) 7 (D) 9

Q.10 In a detailed study of annual crow births in India, it was found that there was relatively no growth during the period 2002 to 2004 and a sudden spike from 2004 to 2005. In another unrelated study, it was found that the revenue from cracker sales in India which remained fairly flat from 2002 to 2004, saw a sudden spike in 2005 before declining again in 2006. The solid line in the graph below refers to annual sale of crackers and the dashed line refers to the annual crow births in India. Choose the most appropriate inference from the above data.



(A) There is a strong correlation between crow birth and cracker sales.
(B) Cracker usage increases crow birth rate.
(C) If cracker sale declines, crow birth will decline.
(D) Increased birth rate of crows will cause an increase in the sale of crackers.

Q. 1 – Q. 25 carry one mark each.

Q.1 In a Colour Wheel, Red and Blue colours are
(A) Tertiary (B) Complementary (C) Secondary (D) Primary

Q.2 In a bird's eye perspective view of a cuboid, the maximum number of vanishing points is
(A) 1 (B) 2 (C) 3 (D) 6

Q.3 The compressive strength of M-25 concrete is
(A) 25 kg/sqm (B) 25 N/sqmm (C) 250 N/sqmm (D) 2.5 N/sqmm

Q.4 In Critical Path Method (CPM) for time scheduling, 'forward pass calculation' is carried out for determining
(A) Late start and early finish time (B) Early start and early finish time
(C) Late start and late finish time (D) Early start and late finish time

Q.5 Collapse of the World Trade Center (WTC), New York, in 2001, was due to
(A) Wind load failure
(B) Foundation failure
(C) Thermal performance failure of reinforcement steel in RCC
(D) Thermal performance failure of structural steel

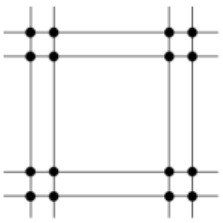
Q.6 During the construction of tall buildings, the equipment used for hoisting building materials to the upper floors is a
(A) Goods lift (B) Capsule lift
(C) Gantry crane (D) Tower crane

Q.7 A Rock-cut style of architecture is represented by
(A) Shyama Rama Temple, Bishnupur (B) Kailasa Temple, Ellora
(C) Kandariya Mahadeva Temple, Khajuraho (D) Sanchi Stupa, Sanchi

Q.8 'Area based development' and 'Pan city development' are part of
(A) Smart City Mission (B) Digital India Mission
(C) Swachh Bharat Mission (D) Atal Innovation Mission

Q.9 In mass transportation, LRTS stands for
(A) Light Rail Transit System (B) Linear Rail Transit System
(C) Light Rail Transportation System (D) Linear Rail Transportation System

Q.10 The structural grid type shown in the figure is a



(A) Tartan Grid
(B) Square Grid
(C) Rectangular Grid
(D) Irregular Grid

Q.11 Assuming other variables remaining constant, the Tropical Summer Index
(A) Increases with increase in air velocity (B) Decreases with increase in wet-bulb temperature
(C) Decreases with increase in globe temperature (D) Increases with increase in vapour pressure

Q.12 Government of India's urban development program 'HRIDAY' stands for
(A) Heritage Rejuvenation Implementation Development Aayog Yojana
(B) Heritage Review Implementation Development Augmentation Yojana
(C) Heritage City Development and Augmentation Yojana
(D) Heritage City Improvement and Development Aawas Yojana

Q.13 As per the Urban and Regional Development Plan Formulation and Implementation (URDPFI) guidelines, the plan period considered in a 'Perspective plan' is
(A) 1-10 years (B) 11-15 years (C) 20-30 years (D) 35-45 years

Q.14 The Hall of Nations, New Delhi, was designed by
(A) Charles Correa (B) Raj Rewal (C) Joseph Allen Stein (D) A. P. Kanvinde

Q.15 As per the National Building Code of India 2016, the minimum turning radius (in metres) required for fire tender movement is

Marking Scheme: Questions Q.1 – Q.25 carry 1mark each. Questions Q.26 – Q.55 carry 2marks each.
Questions Q.56 – Q.60 carry 1mark each, and questions Q.61 – Q.65 carry 2marks each.
For all 1 mark questions, ⅓ mark will be deducted for each wrong answer. For all 2 marks questions, ⅔ mark will be deducted for each wrong answer. However, in the case of the linked answer question pair, there will be negative marks only for wrong answer to the first question and no negative marks for wrong answer to the second question. There is no negative marking for questions of numerical answer type.

Q.1 In case of residential apartments, the effective floor area available for use within an apartment, is known as
(A) Carpet Area (B) Built-up Area (C) Plinth Area (D) Super Built-up Area

Q.2 Star Rating of an Air Conditioner is determined by its
(A) Power Consumption (B) Energy Efficiency Ratio (C) Cooling Capacity (D) Power of Compressor

Q.3 V7 concept given by Le Corbusier refers to
(A) Neighbourhood Planning (B) Housing Typologies (C) Architecture Design Principle (D) Hierarchy of Roads

Q.4 In AUTOCAD, a line of infinite length in the direction defined by starting point and through point,is known as
(A) RAY (B) LINE (C) PLINE (D) XLINE

Q.5 Orbit Tower built at the London Olympic Park has been designed by
(A) Foster & Partners (B) Anish Kapoor & Cecil Balmond
(C) Zaha Hadid & Antony Gormley (D) Richard Rogers & Renzo Piano

Q.6 As per National Building Code 2005, the minimum size of a habitable room in m2 is
(A) 9.5 (B) 10.5 (C) 11.5 (D) 12.5

Q.7 The urban form of Srirangam town in Tamil Nadu refers to
(A) Dandaka (B) Swastika (C) Nandyavarta (D) Sarvotabhadra

Q.8 PMGSY, a programme of Government of India, deals with
(A) Urban Employment Generation (B) Rural Employment Generation (C) Rural Electrification (D) Rural Road Development

Q.9 Beam or lowest division of the entablature which extends from column to column, is known as
(A) Arabesque (B) Arcade (C) Architrave (D) Arbour

Q.10 The information that is NOT essential to be submitted for sanction of any building plan is
(A) Site Plan (B) Floor Plans (C) Title Deed (D) Land Cost

Q.11 The tendency of an ecosystem to maintain its balance by regulatory mechanisms when disrupted, is known as
(A) Homeostasis (B) Entropy (C) Succession (D) Evolution

Q.12 Gantt Chart DOES NOT provide information about
(A) List of Jobs (B) Duration of Jobs (C) Interdependency of Jobs (D) Progress of Work

Q.13 If threshold of hearing has a sound level of zero decibels and the sound level in a broadcasting studio is 100 times the threshold of hearing, its value in decibels would be
(A) 0 (B) 10 (C) 20 (D) 100

Q.14 The width to height ratio of the front facade of Parthenon (without the pediment) is
(A) 9:4 (B) 4:9 (C) 1:1.618 (D) 1.618:1

Q.15 The face of an Icosahedron is
(A) Equilateral Triangle (B) Isosceles Triangle (C) Square (D) Pentagon

Q1. The cubical content of a cement bag of 50 kg is generally
(A) 0.25 cu.m (B) 0.034 cu.m (C) 0.043 cu.m (D) 0.05 cu.m

Q2. A line segment PQ is divided into two parts using the Golden Mean ratio. Segment A is smaller than segment B. The only relationship that holds true for the line PQ is
(A) A/B = A/(A+B) (B) A/B = B/(A+B) (C) (A+B)/A = (B-A)/B (D) (A+B)/A = (P+Q)/P

Q3. A typical fire fighting underground static tank for a 20 m high building should have a pump capacity of
(A) 2400 lit/hour and pressure of 3.0 N/mm^2 (B) 2400 gallons/hour and pressure of 0.3 N/mm^2
(C) 2400 gallons/min and pressure of 3.0 N/mm^2 (D) 2400 lit/min and pressure of 0.3 N/mm^2

Q4. The first four terms of a Fibonacci series are 1, 1, 2, 3, …The sixth term of the series will be
(A) 5 (B) 8 (C) 11 (D) 18

Q5. Two loading diagrams P and Q are shown. Their corresponding maximum Bending Moments (P and Q respectively) are
(A) WL/4, WL/8
(B) WL/2, WL/4
(C) WL/8, WL/4
(D) WL/4, WL/2

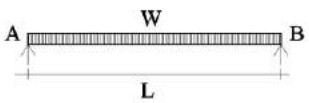


Figure P
Uniformly Distributed Load

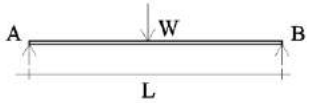


Figure Q
Point Load

Q6. In a rectangular room of length 4 m and width 3 m, an electric bulb is to be fixed above the work plane. If the room index is 1, the ideal mounting height of the bulb from the floor should be
(A) 2.3 m (B) 1.33 m (C) 1.7 m (D) 2.0 m

Q7. Two 15 cm cubes of concrete are cast in a Building Materials Testing Laboratory, one of grade M15 and the other M20. The specified characteristic compressive strength of the stronger block at 28 days will be
(A) 15 N/mm^2 (B) 20 N/mm^2 (C) 1.5 N/mm^2 (D) 0.88 N/mm^2

Q8. For a two way RCC slab, the Length to Width (L/W) ratio should be
(A) 0.5 <_ L/W <_ 2.0 (B) 2.0 <_ L/W <_ 3.0
(C) 2.5 <_ L/W <_ 4.0 (D) 0.0 <_ L/W <_ 0.5

Q9. The distance between two points on a map of scale 1:40,000 is 3.6 cm. The distance between the same two points in an aerial photograph is 6 cm. The scale of the aerial photograph is
(A) 1: 12000 (B) 1: 2400 (C) 1: 240000 (D) 1: 24000

Q10. A camera is used to shoot an aerial photograph from a flight. The scale of the photograph is 1:40000. If the flying height above mean sea level is 7500 m, and the mean ground level is 1500 m, then the focal length of the camera lens is
(A) 70 mm (B) 150 mm (C) 200 mm (D) 50 mm

Q 11. In a multipurpose hall, 30 tube lights of 40 W each are switched on for 5 hours. The electric meter will record a power consumption of
(A) 6 units (B) 12 units (C) 30 units (D) 60 units

Common Data Questions:
A town with an area of 340 hectares has 15,000 households. The number of occupied dwelling units is 12,400 of which 15% are in dilapidated condition. 5% of the households are below poverty line and unable to afford any type of dwelling. (DU = Dwelling Unit)

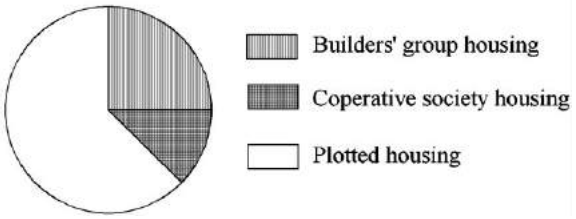
Q12. The present density of the town (in DU/acre) is approximately
(A) 15 (B) 18 (C) 37 (D) 44

Q13. The housing need of the town is approximately

(A) 90-120 meters (B) 50-80 meters (C) 120 – 150 meters (D) 150 – 300 meters

2.6 What is the rate of ventilation due to wind action if the free area of the window is 1 sq.m., and the wind speed is 1 m/hr. Assume the wind to be perpendicular to the window.
(A) 1.0 cu.m./hour (B) 0.6 cu.m./hour (C) 0.3 cu.m./hour (D) 0.1 cu.m./hour

2.7 The diagram below shows the relative distribution of different types of housing within a total residential area of 150 hectares. If the net density of the plotted housing area is 350 ppha., how many people will be accommodated there?
(A) 20,000-25,000 (B) 25,000-30,000
(C) 30,000-35,000 (D) 35,000-40,000



2.8 As per 1991 Census, the urban component of India's total population was between
(A) 10% and 20% (B) 20% and 30% (C) 30% and 40% (D) 40% and 50%

2.9 Zinc coating is given over the steel reinforcement to
(A) increase tensile strength (B) reduce bending capacity (C) reduce corrosion (D) increase bind strength

2.10 Which of the following sequence of names constitutes the botanical name for identification and use of landscape plants? (A) species and order (B) order and species (C) family and species D) genera and species

2.11 For a four-way road intersection the following alternative traffic management schemes are proposed.
i) signalised intersection
ii) manually controlled intersection
iii) rotary intersection
Considering the above alternatives, which of the following statements is INCORRECT?
(A) All are equally space consuming
(B) (i) is more power consuming than (ii) and (iii)
(C) (ii) is more manpower consuming than (i) and (iii)
(D) (iii) is less power and manpower consuming than 'i' and 'ii'

2.12. A residential plot of 20 metre frontage and 25 metre depth is governed by the development regulations of maximum FAR of 200 and maximum plot coverage of 50%. Up to what maximum height can the plot be built?
(A) 2 floors (B) 3 floors (C) 4 floors (D) 10 floors

2.13 Minimum visibility distance at a major road intersection, for a design speed of 80 kmph is
(A) 200 metres (B) 180 metres (C) 80 metres (D) 100 metres

2.14 For accumulation of Re. 1/- for 'n' years at a given rate of compound interest 'i', the annual sinking fund is equal to (A) 1/i (B) $(1+i)^n$ (C) $\{ (1+i)^n - 1\} / i$ (D) $i / \{(1+i)^n - 1\}$

2.15 Which of the following parametric condition will provide the most suitable land for intensive development of settlement?
(A) slope = 4%; soil = silty loam aggregate; depth of water table = 6 metres; vegetation = moderate
(B) slope = 20%; soil = aggregate sand; depth of water table = 30 metres; vegetation = barren.
(C) slope = 2 %; soil = clay; depth of water table = 1 metre
(D) slope = 10%; soil = sandy loam; depth of water table = 15 metres; vegetation = dense

2.16. A rectangular room (internal dimension 5 m x 3 m) is made of 250 mm walls. Calculate the volume of concrete needed for 25 mm Damp Proof Course.
(A) 0.425 cu.m. (B) 4.25 cu.m. (C) 0.4 cu.m. (D) 4.0 cu.m.

Duration: 3 hours Maximum marks: 150 **No negative marking**

Section A consists of three Sub sections A1, A2, A3.

Section B has two parts: Part I and Part II. Answer either Part I or Part II. From the chosen part, answer any fifteen questions.

Section A (75 Marks)
Subsection A1 (30 Marks, 2 Marks each)

1.1 'Peristyle' in architecture means
(A) a row of free standing columns surrounding an area (B) perimeter wall of an enclosed shrine
(C) perishable materials in buildings (D) the triangular part above the entablature in the classic order

1.2 Washington DC, is an example of
(A) linear urban form (B) star shaped urban form
(C) poly-centred net urban form (D) the sheet urban form

1.3 SON lamps operate on the principle of discharge in
(A) Sodium vapour (B) Krypton vapour (C) Mercury vapour (D) Zinc and Cadmium vapour

1.4 A method of Control survey, in which a network of triangles is used in
(A) Triangulation (B) Three-point resection (C) Trilateration (D) None of these

1.5 Hyperbolic paraboloid can be generated by
(A) a curve moving over two straight lines at obtuse angles
(B) a straight line moving over curve at acute angle
(C) a curve moving over two other parallel curves
(D) a straight line moving over two other straight lines at an angle to one another

1.6 'Savannas' are
(A) grasslands with draught-resistant trees (B) parts of arctic regions with moving glaciers
(C) estuaries, where delta is formed (D) parts of desert with perennial water pockets

1.7 Variability of project duration in PERT analysis is measured in terms of
(A) pessimistic time difference (B) optimistic time difference
(C) time difference of activities (D) square of standard deviation of activity duration

1.8 The term 'Necropolis' refers to
(A) small size metropolis (B) the new metropolis (C) dead city (D) the city in space

1.9 Phenomenon of contorted growth of trees due to unequal irradiation of light on two sides is known as
(A) Photosynthesis (B) Phototropism (C) Photoperiodism (D) Photorespiration

1.10 The total quantity of runoff for an area of 18 hectares in a lateritic region (runoff coefficient = 0.5 and rainfall = 10 mm/hour), is (A) 55 m^3/hr (B) 108 m^3/hr (C) 900 m^3/hr (D) 180 m^3/hr

1.11 The average Lux required on a pavement, having width 4m., is 8. The mounting height of the lamp (lumen 2000) is 4m. The spacing of the lamps (for the coefficient of the utilisation is 0.5 and maintenance factor id 0.8) is
(A) 24m (B) 75m (C) 10m (D) 15m

1.12 In BOT based project, the most important evaluation criterion is
(A) financial internal rate of return (B) internal rate of return (C) benefit-cost ratio (D) present value

1.13 Addition of Decibel levels 92 dBA and 88 dBA amounts to
(A) 97 dBA (B) 150 dBA (C) 180 dBA (D) 93 dBA

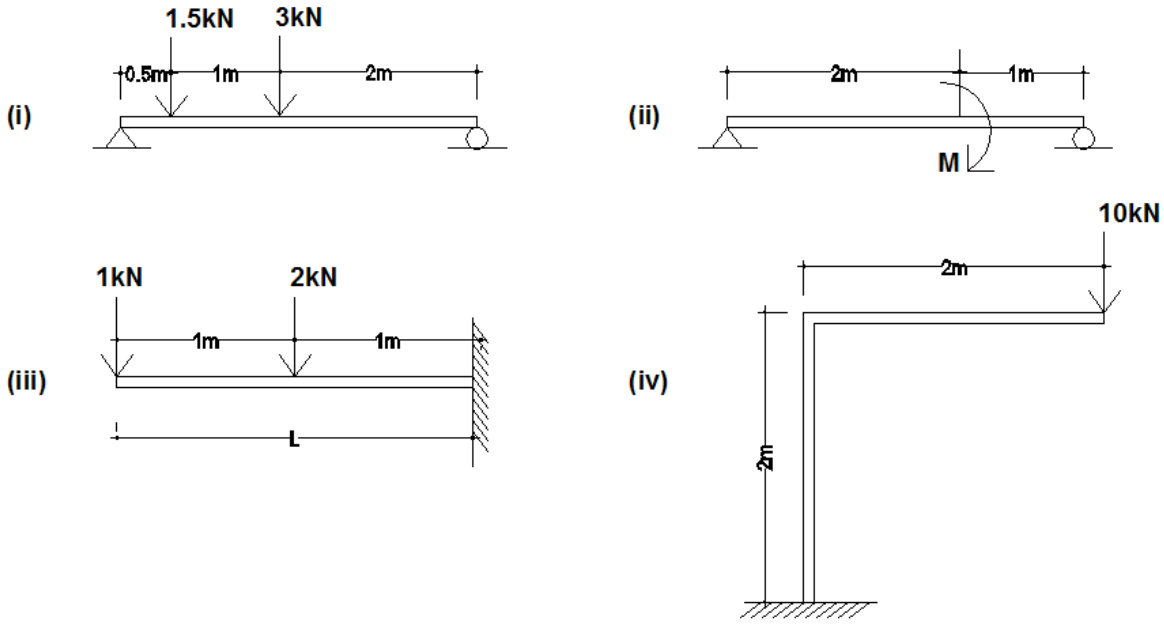
10. Following information about income pattern is available from household survey of a community.

Category	Monthly family income in rupees	Number of families
1	Below 500	45
2	501-1000	62
3	1001-1500	213
4	1501-2000	171
5	2001-3000	76
6	above 3000	33

10.1 Find out percentage of families earning a monthly income above Rs 1,500.

10.2 Draw a pi-diagram showing percentage distribution of various income groups.

11. Draw the bending moment and shear force diagram for the following:



12 List six factors that are considered while selecting a tree for a landscape.

13 Draw the CPM network and determine the critical path from the following data:

SN	Activity	Duration (days)	Preceding activity
1	A	4	-
2	B	10	-
3	C	6	-
4	D	6	A
5	E	8	B
6	F	3	C
7	G	7	D
8	H	2	E

14. Find the errors in the following FORTRAN program: (Out of syllabus now!)

15 Draw a sketch of a typical Greek Temple facade and name the important elements.

END OF THE QUESTION PAPER GATE 1992

Microwatt is a power measurement unit. A microwatt (μW) is a derived metric SI (System International) measurement unit of power. The microwatt is equal to one millionth of a watt (10^{-6}W)

18. Principal determinants of a residential neighbourhood size is based on:
(A) Landuse composition (B) Availability of vacant land (C) Education facility (D) Residential density

19. Minimum height of habitable room as prescribed in NBC :
(A) 1.85 m (B) 2.75 m (C) 3.0 m (D) 3.2 m

20. Desirable housing layout of buildings from acoustic point of view is :
(A) Courtyard type (B) Stilted multistoried flats (C) Open type single or semidetached houses (D) none of the above.

Q2. Match the following:

1	The city in history	A	Patrick Geddes
2	Life and death of great American cities	B	Norberg Schulz
3	The Modular	C	John Ruskin
4	The Future of Housing	D	Charles Abraham
5	Seven Lamps of Architecture	E	Oscar Newman
6	Language of Post — Modem Architecture	F	Lewis Mumford
7	Cities in Evolution	G	Jean Jacob
8	Defensible Space	H	Le Corbusier
9	The New Landscape	I	Charles Jenka
10	Meaning in Western Architecture	J	Charles Correa

Q2.2. Match the following:

1	Crystal Palace	A	Le Corbusier
2	Johnson Wax factory	B	Joseph Paxton
3	Shoden Villa	C	B. V. Doshi
4	German Pavillion, Barcelona	D	Mies Van der Rohe
5	Pompidou Centre Paris	E	Frank Lloyd Wright
6	TWA Terminal, Kennedy Airport	F	Charles Correa
7	Kanchanjunga Apartment, Bombay	G	Eero Saarinen
8	National Institute of Bank Management, Pune	H	A.P. Kanvinde
9	IIM Bangalore	I	Sarat Das
10	Indira Gandhi Sports Complex, Indraprastha	J	R. Rogers and Renzo Piano

2.3 Match the following:

1	Grid Iron Pattern	A	Kautilya
2	Vastu Shastra	B	Hippodamus
3	Satellite Town	C	E. Howard
4	Garden City	D	Raymond Unwin
5	Arthasastra	E	Mansara

2.3 Match the following:

1	Chandigarh	A	C.A. Doxiadis
2	New Delhi	B	Otto Koenigsberger
3	Gandhi Nagar	C	Mewada
4	Islamabad	D	Le Corbusier
5	Bhubaneswar	E	Edwin Lutyen

Q2.2. Match the following:

1	Munsell Atlas	A	Gothic
2	Low air speed	B	Landscape
3	Kinaesthetia	C	Colour
4	Jantar Mantar	D	Raja Jai Singh
5	Flying Buttress	E	Kata Thermometer
6	Hypostyle Hall	F	Egyptian

ANSWER GATE 2018

Aptitude Section:

Q.1 (A) stairs, stares
Q.2 (C) errant
Q.3 (B) ($\pi/2$, π)
Q.4 (C) 6
Q.5 (D) (iv), (iii), (ii), (i)
Q.6 (A) 72
Q.7 (C) 60
Q.8 (D) 4,20,000
Q.9 (C) 7
Q.10 (A) There is a strong correlation between crow birth and cracker sales.

Architecture Section:

Q.1 (D) Primary
Q.2 (C) 3
Q.3 (B) 25 N/sqmm
Q.4 (B) Early start and early finish time
Q.5 (D) Thermal performance failure of structural steel
Q.6 (D) Tower crane
Q.7 (B) Kailasa Temple, Ellora
Q.8 (A) Smart City Mission
Q.9 (A) Light Rail Transit System
Q.10 (A) Tartan Grid
Q.11 (D) Increases with increase in vapour pressure
Q.12 (C) Heritage City Development and Augmentation Yojana
Q.13 (C) 20-30 years
Q.14 (B) Raj Rewal
Q.15 (C) 9.0
Q.16 (C) Ahmedabad
Q.17 (A) Road intersection
Q.18 (D) Land readjustment
Q.19 (D) Perennial grass
Q.20 Options (A), (B) & (C) are correct after review of GATE official.
Q.21 (C) sqm
Q.22 (A) Adobe Illustrator
Q.23 (B) Altitude angle
Q.24 Answer: 5.3 to 5.7
Q.25 Answer: 7.0
Q.26 (D) P-3, Q-5, R-4, S-1
Q.27 (C) P-3, Q-5, R-1, S-2
Q.28 (D) P-3, Q-1, R-2, S-4
Q.29 (D) P-5, Q-3, R-4, S-2
Q.30 (D) P-5, Q-3, R-4, S-2
Q.31 (C) P-4, Q-5, R-2, S-1
Q.32 (B) P-5, Q-4, R-1, S-2
Q.33 (C) P-4, Q-3, R-5, S-2
Q.34 (B) P-2, Q-3, R-1, S-5
Q.35 (A) P-5, Q-3, R-1, S-4
Q.36 (A) P-2, Q-1, R-4, S-3
Q.37 (C) P-2, Q-1, R-5, S-3
Q.38 (A) P-4, Q-5, R-1, S-2

Q.39 (A) P-3, Q-4, R-2, S-5
Q.40 (B) P-2, Q-1, R-4, S-5
Q.41 Answer: 3.7 to 3.8
Q.42 Answer: 15
Q.43 Answer: 104
Q.44 Answer: 440
Q.45 Answer: 600
Q.46 Answer: 21600
Q.47 Answer: 69.5 to 70.5
Q.48 Answer: 7.8 to 7.9
Q.49 Official GATE answer varied from 224 to 226
Q.50 Answer: 8100
Q.51 Answer: 5 to 9
Q.52 Answer: 58 to 60
Q.53 Answer: 4 to 5
Q.54 Answer: 107
Q.55 Answer: 20

ANSWER GATE 2017

Q.1 (A) P-5, Q-1, R-2, S-4
Q.2 (A) Alejandro Aravena
Q.3 (A) Sabin
Q.4 Answer: 0.24
Q.5 (D) P-3, Q-2, R-5, S-1
Q.6 Answer: 178 lux
Q.7 (B) 50
Q8. (A) Lancet arch
Q9. Answer: 7.2 meter
Q10. Answer:15 Months
Q11. Answer: 1750
Q12. Answer: (C)
Q13. Answer: 8
Q14. Answer: 8500
Q15. Answer (C)
Q16. Answer: 3464
Q17. Answer: 0
Q18. Answer: 28
Q19. Answer (C)
Q20. Answer: 960
Q21. Answer: 1100 Jobs
Q22. (B) P-1, Q-5, R-2, S-3
Q23. (A) Trumpet
Q24. (D) P-4, Q-5, R-2, S-1
Q25. (D) $10\pi/13$
Q26. (C) Quenching
Q27. (A) P-2, Q-1, R-5, S-3
Q28. Answer: (D) has high spatial resolution
Q29. Answer: 200000
Q30. Answer: (B) Effective length / Radius of gyration
Q31. Answer: (D) Roman ArchitectureQ32. Answer: 41000
Q33. (A) 0
Q34. (B) Steve was known to play better than Mark
Q35. (B) Rs. 30.000
Q36. Answer: (B) interface between an already setting concrete and a fresh batch of concrete
Q37. (B) Compensation paid on breach of contract to the affected party by the other party
Q38. (B) Redevelopment – Greenfield development – Retrofitting
Q39. (C) Flocculation
Q40. (D) Acquire and take possession of property in order to promote public interest
Q41. (D) two pipe system

Q42. Answer: 40 (This answer was challenged, earlier it was 0.4)
Q43. (B) housing shortage
Q44. (D) topography
Q45. (B) Build, Own, Operate, Transfer (BOOT)
Q46. (D) labour safety
Q47. (C) Gordon Cullen
Q48. (C) P-2, Q-1, R-4, S-5
Q49. (B) P-2, Q-1, R-3, S-5
Q50. (D) P-4, Q-5, R-3, S-1
Q51. (B) P-5, Q-4, R-1, S-3
Q52. Answer: 2.7 to 2.9
Q53. Answer: 390
Q54. (C) P4, Q-1, R-2, S-3
Q55. (A) P-5, Q-4, R-2, S-3
Q56. (A) P-3, Q-4, R-1, S-2
Q67. Answer: 60
Q58. (A) P-5, Q-3, R-2, S-1
Q59. (A) P-3, Q-1, R-4, S-2
Q60. (D) heated
Q61. (D) friends, keenly
Q62. (C) 32
Q63. (C) Stuart's 'losing battle' refers to his inability to succeed in enabling sepoys to wear caste-marks.
Q64. Answer (D) Cannot be determined
Q65. (A) Only i

ANSWER GATE 2016

Part1 – Aptitude

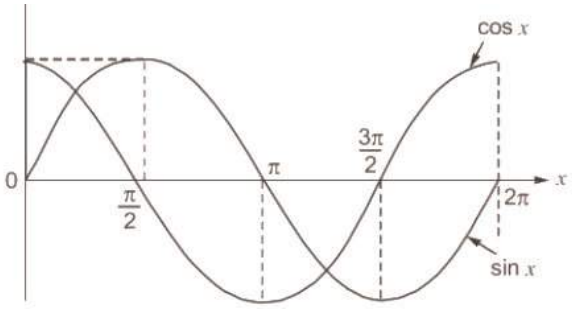
Q1. (C) The price of an apple is greater than that of an onion.
Q2. (A) 2.0
Q3. (C) 97
Q4. (C) clutching
Q5. (B) P is the grandchild of M.
Q6. (A) −0.030
Q7. (A) The number of people in India infected with rabies is high.
Q8. (C) 15.70
Q9. (C) Trideep
Q10. (D) 5

Part 2 – Architecture

Q1. (A) W/(m K) (Watt per meter per degree Kelvin)
Q2. (C) Plate Action
Q3. (A) Building height
Q4. (D) Urban area with a statutory local government
Q5. (A) Atal Mission for Rejuvenation and Urban Transformation
Q6. (D) Topology
Q7. (C) Reduces the SHGC
Q8. (A) Life expectancy, Education and Per Capita Income
Q9. (A) Japanese Garden
Q10. (D) Mihrab
Q11. (D) Johnson Wax Building, Racine
Q12. (B) Le Corbusier
Q13. (C) Heritage tower at Kathmandu
Q14. (A) 900
Q15. (B) Black
Q16. (A) Reduce the water-cement ratio for a given workability
Q17. (B) Charles Correa

Q1. Stairs - A construction designed to bridge a large vertical distance by dividing it into smaller vertical distances, called steps.
Stares - To look at someone for a long time.

Q2. Errant means misbehaving, exhibiting inappropriate behavior / offending conduct.



Q3. From the curve it is clear that sin*x* and cos*x* both are decreasing in the interval $(\pi/2\ ,\ \pi)$
How to plot the graph? To plot this graph you need to know the value of sinθ & cosθ for the values of 0°, 30°, 45°, 60° and 90°. For that you do not have to remember the values. Open the 'Scientific Calculator' by clicking on the icon of calculator on the question screen during GATE exam.

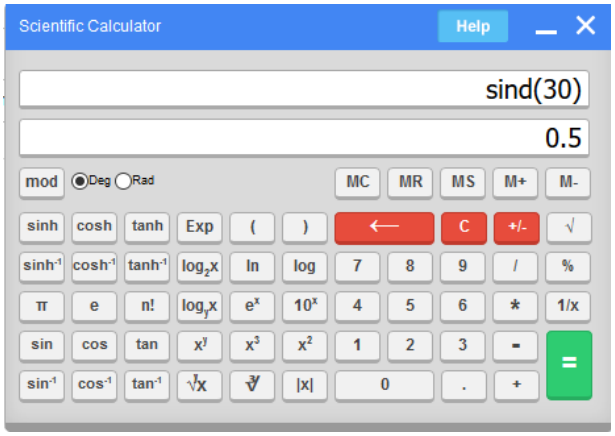
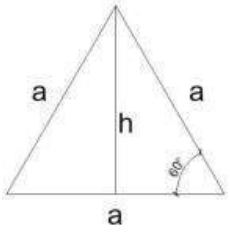


Figure: Visit the official GATE website and appear for a Mock Test to be familiar with function of the 'Scientific Calculator' and UI.

Q4. Area of triangle = 1/2 (Base*Height) = 1/2 (a*h)
= 1/2 (a*a *sin60°*) = 1/2 ($a^2\sqrt{3}/2$) = $\sqrt{3}$ (given)

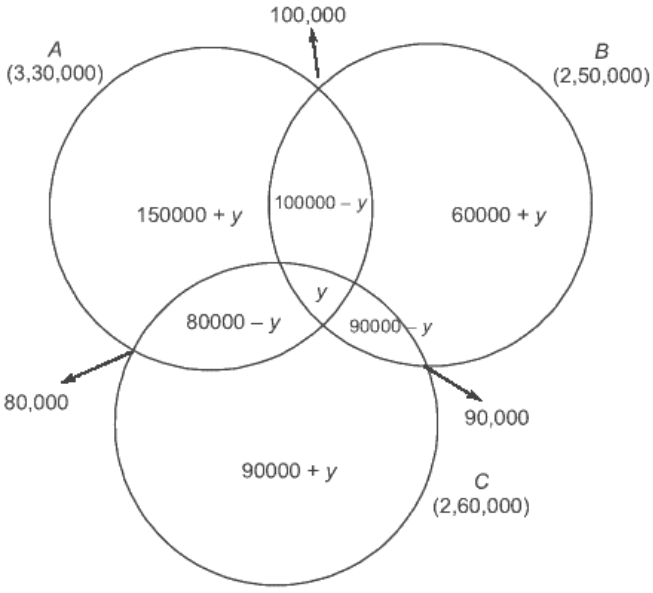


So, perimeter of triangle = 3*a = 3*2 = 6 **Answer**

Q5. Volume of cuboid = l*b*h = 10*8*6 = 480
Volume of cube = $l^3 = 8^3 = 512$
Volume of cylinder = (perimeter)*(height) = 2πr*h = 2π7*7 = 615
Volume of sphere = 4/3* πr^3 = 1432

Q.6 Solution: Let, the distance between city A & B be ***x***
So, total distance (onward & return journey) = x + x = 2x
For onward journey, speed S1 = 60km/h and time taken = x/60
For return journey, speed S2 = 90km/h and time taken = x/90
Therefore, Average Speed = Total Distance/Total Time = (x+x)/[x/60+x/90] = 2*90*2/5 = **72 km/h**

Q.7 Solution: To make a parallelogram we need two parallel lines in one direction and other two parallel lines in other direction. It is given that we have 4 parallel lines in one direction and 5 parallel lines in other direction. Now, we have to choose any 2 parallel lines from 4 parallel lines and other 2 lines from the other 5 parallel lines. In mathematics, number of parallelogram = $^4C_2 \times {}^5C_2$ = 6*10 = **60 Answer**



Q.8 6,30,000 = 2y + 1,50,000 + 1,00,000 + 80,000 + 60,000 + 90,000 + 90,000
⇨ 6,30,000 – 5,70,000 = 2y
⇨ y = 30,000 Answer
Student who failed to clear the test = 1,50,000 + 60,000 + 90,000 + 4y = 3,00,000 + 4*30,000 = **4,20,000 Answer**

Q.9 Solution: $x^2 + x = 1$
x (x +1) = 1
x + 1 = 1/x
(x-1/x) = (-1)
Squaring the above equation,

$x^2 + 1/x^2 - 2 = (+1)$
$x^2 + 1/x^2 = 3$
Squaring above equation,
$x^4 + 1/x^4 + 2 = 9$
$x^4 + 1/x^4 =$ **7 Answer**

Q.10 Solution: Option (B) is incorrect as there is no any factor mentioned in the paragraph that could affect the crow birth rate due to uses of cracker. For the same reason options (C) and (D) are invalid. So, the correct option is (A).

Q.1 *Notes:* **Primary Colors**: Red, yellow and blue
In traditional color theory (used in paint and pigments), primary colors are the 3 pigment colors that cannot be mixed or formed by any combination of other colors. All other colors are derived from these 3 hues.

Secondary Colors: Green, orange and purple
These are the colors formed by mixing the primary colors.

Tertiary Colors: Yellow-orange, red-orange, red-purple, blue-purple, blue-green & yellow-green
These are the colors formed by mixing a primary and a secondary color. That's why the hue is a two word name, such as blue-green, red-violet, and yellow-orange.

Q.2 *Notes:* **One point perspective**
Imagine driving along a very straight open road on a grassy plain. The road, the fences, and power-poles all diminish towards a single spot far ahead of you. That's single-point perspective.
Three-Point Perspective
In three-point perspective, there are three vanishing points (VPs). Two are along the horizon, just like two-point, but the third VP is located either above the horizon (at the **zenith**) or below the horizon (the **nadir**), depending on the area you intend to draw.

Q.3 *Notes:* IS 456-2000 has designated the concrete mixes into a number of grades as M10, M15, M20, M25, M30, M35 and M40. In this designation, the letter M refers to the mix and the number to the specified 28 day cube strength of mix in N/mm^2. The mixes of grades M10, M15, M20 and M25 correspond approximately to the mix proportions (1:3:6), (1:2:4), (1:1.5:3) and (1:1:2) respectively.
So, for M25, the M stands for mix and 25 represents the characteristic strength of concrete.
The **characteristic strength** is defined as the **strength** of the **concrete** below which not more than **5%** of the test results are expected to fall. In simpler terms, if you cast 100 cubes of 15cm*15cm*15cm and test their compressive strength using compression testing machines after 28 days, then not more than 5 cubes should fail at a value lesser than 25 N/mm^2 (25 MPa).

MPa = Mega Pascal (Mega = 10^6 & Pascal = N/m^2, So 1 MPa= 10^6 *N / m2)*
The pascal (symbol Pa) is the SI unit of pressure. It is equivalent to one newton per square metre. The unit is named after Blaise Pascal, the eminent French mathematician, physicist and philosopher.

Q.7 About **Bishnupur** (The temple town, West-Bengal): Known for its beautiful terracotta temples, Bishnupur flourished as the capital of the Malla kings from the 16th to the early 19th centuries. The architecture of these intriguing temples is a bold mix of Bengali, Islamic and Oriya (Odishan) styles. Intricately detailed facades of numerous temples play out scenes of the Hindu epics, the Ramayana and Mahabharata.
Stone has always been in short supply in the vast flood plains of Bengal. Hence the architects had to restore to other substitute. As clay was easily available the burnt clay bricks soon became a good substitute of stone. This gave rise to a new form of temple architecture and lead to the construction of elaborately decorated terracotta temples.
Terracotta literally means baked earth in Italian but West Bengal has the distinction of housing some of the finest terracotta art in the world. The terracotta art reached its pinnacle under the patronage of the Malla Kings of Bishnupur during the seventeenth century.
Temples in Bishnupur: There are more than 20 temples in a small vicinity. Few described below.

Shyamrai Temple: A left turn from the Ghumghar leads to the Shyamrai Temple**,** popularly known as the Pachchura temple, because of its five pinnacles. Built by Mallaraja Raghunath Singha in 1643 this is terracotta at its best. Approached by triple arched entrance on all the four sides the Shyamrai Temple contains terracotta on all its four sides including the inner walls and the pinnacles. The Ras Chakra and love making scenes of Radha – Krishna are the most sort after terracotta panels of the Shyamrai Temple.
Source: https://www.sahapedia.org/bishnupur-land-of-terracotta-temples
https://rangandatta.wordpress.com/2013/07/10/bishnupur-temple-town/

"**The Kailasa Temple**, it is safe to say, is one of the most astonishing 'buildings' in the history of architecture. This shrine was not constructed of stone on stone, it was in fact not constructed at all: it was carved, sculpted from the volcanic hillside! A squared, U-shaped trench was first cut into the slope to a depth of close to 100 feet. The 'liberated' mass in the center was then patiently carved from the living rock to produce a freestanding, two-story temple of dazzling complexity. The temple, which is dedicated to Shiva, measures 109 feet wide by 164 feet long. It stands on an elevated plinth to attain greater presence in its tight surroundings. The complex consists of entry, Nandi (i.e. bull) shrine, open porch, main hall, and inner sanctum. Variously scaled panels, friezes, and sculpture highlight many surfaces."

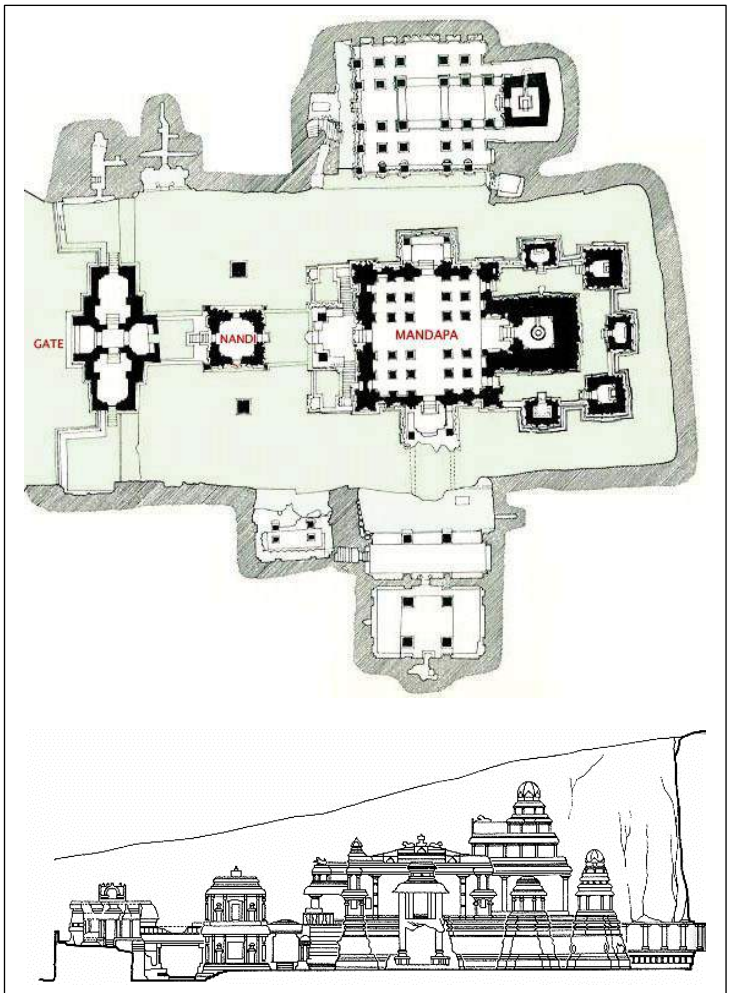


Figure: The Kailasa Temple. Plan & Elevation.

Khajuraho temples are a pinnacle of the North Indian *Nagara* architectural style.
The *Nagara* style's primary feature is a central tower (*shikhara)* whose highest point is directly over the temple's primary deity. This is often surrounded by smaller, subsidiary towers *(urushringa)* and intermediate towers; these naturally draw the eye up to the highest point, like a series of hills leading to a distant peak. Setting the temple on a raised base *(adhisthana)* also shifts the eye upward, and promotes this vertical quality.

The Great Stupa at Sanchi, in central India, is one of the earliest stupas; it served as an architectural prototype for all others that followed. The world-famous stupa — first constructed by the 3rd century BCE Mauryan ruler Ashoka in brick (the same material as those of Sri Lanka) — was later expanded to twice its original size in stone.

In the most basic sense, as an architectural representation of a sacred burial site, a stupa—no matter where it is located in the world or when it was built—has three fundamental features.

- **A hemispherical mound (anda).** The anda's domed shape (green highlights) recalls a mound of dirt that was used to cover the Buddha's remains. As you might expect, it has a solid core and cannot be entered. Consistent with their symbolic associations, the earliest stupas contained actual relics of the Buddha; the relic chamber, buried deep inside the anda, is called the tabena. Over time, this hemispherical mound has taken on an even grander symbolic association: the mountain home of the gods at the center of the universe.
- **A square railing (harmika).** The harmika (red highlights) is inspired by a square railing or fence that surrounded the mound of dirt, marking it as a sacred burial site.
- **A central pillar supporting a triple-umbrella form (chattra).**The chattra, in turn, was derived from umbrellas that were placed over the mound to protect it from the elements (purple highlights). Just as the anda's symbolic value expanded over time, the central pillar that holds the umbrellas has come to represent the pivot of the universe, the axis mundi along which the divine descends from heaven and becomes accessible to humanity. And the three circular umbrella-like disks represent the three Jewels, or Triantha, of Buddhism, which are the keys to a true understanding of the faith: (a) Buddha; (b) dharma (Buddhist teachings or religious law); and (c) sangha (monastic community).

Around these three core building blocks were added secondary features.

- **Enclosure wall with decorated gateways (toranas) at the cardinal directions.** The wall — with its trademark three horizontal stone bars (in the top image) — surrounds the entire structure. The wall is marked in light blue highlights and the toranas in yellow.
- **A circular terrace (medhi).** The terrace—surrounded by a similar three-bar railing—supports the anda and raises it off the ground (black highlights); it likely served as a platform for ritual circumambulation.

Source: http://www.approachguides.com/blog/buddhist-stupa-architecture-symbolism/

Part 1- Aptitude

Q2. Solution: Speed of the first train = length/time = 120/10 = 12m/s
Speed of the second train = length/time = 150/15 = 10m/s
2.0 m/s is the difference in the train speed.

Q3. Answer: 97 is the odd number out. All other numbers are squares.
324 = 18*18
441 = 21*21
64 = 8*8

Q6. Solution: The equation of a line is
y = mx + c where m is the slope & c is the y-intercept
Now, In this question x is replaced with **ln**x
So, the equation of line becomes,
y = mlnx + c
or, y = -0.02lnx + c
We have given with **abscissa** which is essentially x-intercept. So, now we have to find 'c' the y-intercept.
for, y = 0, lnx = 0.1 (given in the question)
Putting the value,
0 = -0.02x0.1 + c
or, c = 0.002
So, the equation of line becomes,
y = -0.02lnx + 0.002
putting x = 5 (asked in the question)
y = -0.002ln5 + 0.002 = -0.002x1.6 + 0.002 = **-0.03**
(ln5 = 1.6)

Q8. Solution: Let orange line be, **3x+2y=14**
and blue line be, **2x-3y=5**
Solving both equation, we get, (x=4, y=1) the intersection points of the lines.
To get the required area in the first quadrant, we have to deduct the area of the triangle formed by the orange line, blue line & the x-axis from the area bounded by the orange line in the first quadrant.
Area of the triangle = 1/2 x base x height = 1/2 x B x A = 1/2 x 13/6 x 1 = 13/12 .....(P)
Area bounded by orange line and X & Y axis
= (1/2) x (x-intercept) x (y-intercept) = 1/2x14/2x7 = 98/6 .....(Q)
So, required area = (Q) - (P) = 98/6 - 13/12 = 183/12 = **15.25**

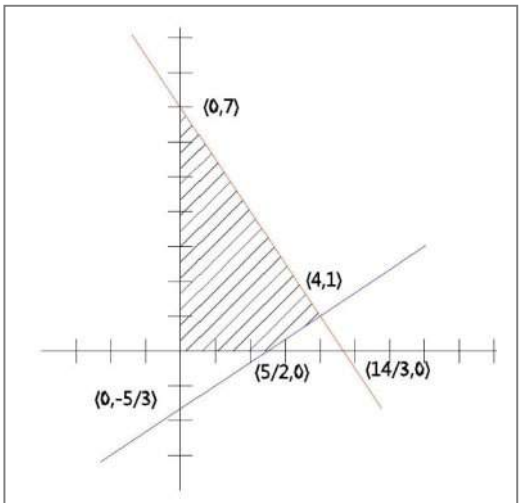


Figure: Intersection points.

Q10. The odometer will read **5**. (The area shaded under the graph).
Odometer is an instrument for measuring the distance travelled by a wheeled vehicle. So, you have to just count the no. of squares made by triangles of the graph.

Part 2 – Architecture

Q1. Answer: (A) **W/(m K)** (Watt per meter per degree Kelvin)
Possible Intent: To test the difference between conductivity & conductance.

K-value – Thermal Conductivity

Thermal conductivity is the time rate of steady state heat flow through a unit area of a homogeneous material induced by a unit temperature gradient in a direction perpendicular to that unit area, W/m·K.
k = q(L/T) Where,
L – Thickness of the specimen (m)
T – Temperature (K)
q – Heat flow rate (W/m2)

Foundation failures could also be considered as heaved foundations, cracked or buckled walls and cracked concrete floors.

48. Notes: Lagerstroemia speciosa, also known by the common name **Pride-of-India**, is a shrub to large tree with multiple trunks or stems diverging from just above ground level. This species can grow up to 15 m in height and has a wide spreading crown.
In India, the wood is used for railroad sleepers and the construction of furniture, wagons, and buildings.
The wood is resistant to waterlogging and therefore is valuable for the construction of boats.
In the Philippines, it is used as a folk medicine for the treatment of diabetes and kidney diseases.
In laboratory experiments leaf extracts are reported to stimulate glucose uptake in a dose-dependent manner in similar ways to insulin.

Cassia fistula, this native of India, commonly known as *Amaltaas*, is one of the most beautiful of all tropical trees when it sheds its leaves and bursts into a mass of long, grape-bunches like yellow gold flowers. A tropical ornamental tree with a trunck consisting of hard reddish wood, growing up to 40 feet tall. The wood is hard and heavy; it is used for cabinet, inlay work, etc. It has showy racemes, up to 2" long, with bright, yellow, fragrant flowers.

Common name: Amaltas, Golden shower tree, Indian Laburnum • Hindi: अमलतास Amaltas • Manipuri: চহঙৈ Chahui • Tamil: கொன்றை Konrai • Malayalam: Vishu konnai • Marathi: बहावा Bahava • Mizo: Ngaingaw • Bengali: সোনালী Sonali, Bandarlati, Amultas • Urdu: املتاس Amaltas
Botanical name: *Cassia fistula* **Family:** *Caesalpiniaceae* (Gulmohar family)

Azadarachta indica . Each part of the neem tree has some medicinal property. The tree is still regarded as 'village dispensary' in India. The importance of the neem tree has been recognized by US National Academy of Sciences, which published a report in 1992 entitled 'Neem – a tree for solving global problems'.

49. Notes: Pradhan Mantri Gram Sadak Yojana (**PMGSY**) was launched on 25th December 2000 as a fully funded Centrally Sponsored Scheme to provide all weather road connectivity in rural areas of the country. The programme envisages connecting all habitations with a population of 500 persons and above in the plain areas and 250 persons and above in hill States, the tribal and the desert areas.

(**JnNURM**) is a massive city-modernisation scheme launched in 2005 which relates primarily to development in the context of urban conglomerates focusing to the Indian cities. JnNURM aims at creating 'economically productive, efficient, equitable and responsive Cities' by a strategy of upgrading the social and economic infrastructure in cities, provision of Basic Services to Urban Poor (BSUP) and wide-ranging urban sector reforms to strengthen municipal governance in accordance with the 74th Constitutional Amendment Act, 1992.

51. Notes: **Gentrification** is the buying and renovation of houses and stores in deteriorated urban neighborhoods by wealthier individuals, which in effect improves property values but also can displace low-income families and small businesses. This is a common and widespread controversial topic and term in urban planning. It refers to shifts in an urban community lifestyle and an increasing share of wealthier residents and/or businesses and increasing property values.

Urban sprawl is the spreading of a city or its suburbs. It often involves the construction of residential and commercial buildings in rural areas or otherwise undeveloped land at the outskirts of a city. Most residents of typical sprawl neighborhoods live in single-family homes and commute by car to their jobs in the city. Concerns over this phenomenon and its consequences have been raised and largely focus on negative consequences for residents and the local environment. On the other hand, some argue that it illustrates positive growth of a local economy.
Urban sprawl typically is used with negative connotations, the economic growth that supports it is viewed as a positive thing by many. In addition, many support the community structure of a suburb as opposed to a city as the pace of life is typically slower and space is not at such a premium. Additionally, suburbs are often, though not necessarily, said to be safer, and as a result these areas are often places people move to to raise their children.

develop a citywide network of railways and arterial roads. The idea of the plan was to concentrate the urban development of Greater Copenhagen in the urban "fingers" created around the railway network.

Q.20 **Workability** is one of the physical parameters of concrete which affects the strength and durability as well as the cost of labor and appearance of the finished product. **Concrete is said to be workable when it is easily placed and compacted homogeneously i.e without bleeding or Segregation**. Unworkable concrete needs more work or effort to be compacted in place, also honeycombs &/or pockets may also be visible in finished concrete.

Definition of Workability

The property of fresh concrete which is indicated by the amount of useful internal work required to fully compact the concrete without bleeding or segregation in the finished product.

Factors affecting workability:

1. Water content in the concrete mix
2. Amount of cement & its Properties
3. Aggregate Grading (Size Distribution)
4. Nature of Aggregate Particles (Shape, Surface Texture, Porosity etc.)
5. Temperature of the concrete mix
6. Humidity of the environment
7. Mode of compaction
8. Method of placement of concrete
9. Method of transmission of concrete

Q.21 A **buttress** is an architectural structure built against or projecting from a wall which serves to support or reinforce the wall.

Q.23 Winder- a staircase step for changing direction.

Q.25 **Concentric Zone theory**

The theory, proposed by E. W. Burgess (1926), that urban land use may be classified as a series of concentric zones.

Zone I, the CBD, lies at the centre of the city. Zone II is in transition. It is the crowded, multi-occupied zone of the city first invaded by migrants. Within this Zone are the ghetto areas (these are not necessarily slums). In Zone III are the working men's houses, the area of second generation immigrants, one step up from Zone II. Zones IV and V are residential; Zone IV for the better-off and Zone V for the commuters. All these zones are held to have evolved separately and without planning. They result from the competition of different socio-economic groups for land. This competition results in variations in the cost of land and, therefore, causes segregation within a city. The model assumes uniformly flat, and available, land, and ignores the importance of transport routes, but relies on the theory that city growth results from distinct waves of in-migrants, that is to invasion and succession. In this last respect it is therefore more applicable to cities in the USA than to European cities.

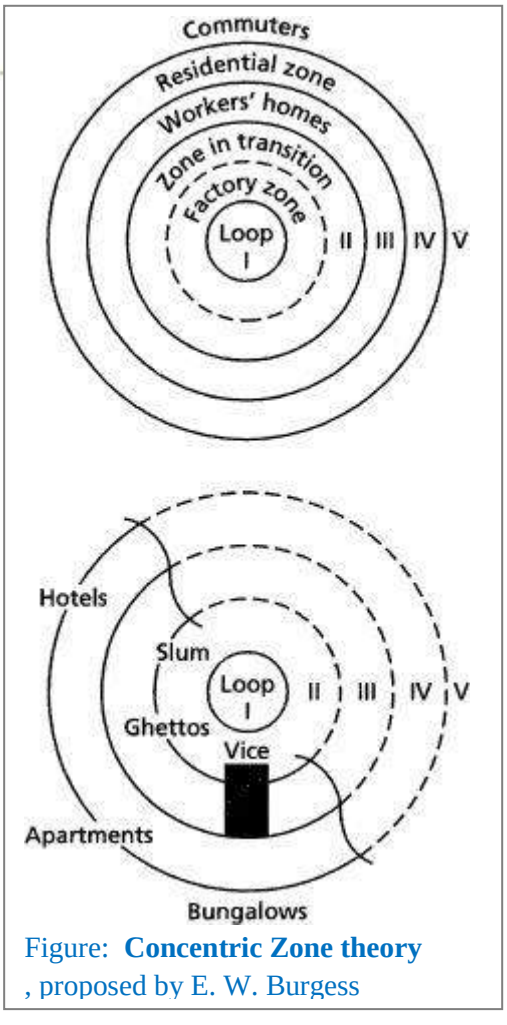


Figure: **Concentric Zone theory** , proposed by E. W. Burgess

Multiple Nuclei Theory

A model of town growth advanced by C. D. Harris and E. L. Ullman (*Annals of the American Academy of Political and Social Sciences*. 242) based on the fact that many towns and nearly all large cities grow about many nuclei rather than around a simple CBD. Some of these nuclei are pre-existing settlements, others arise from urbanization and external economies. Distinctive land-use zones develop because some activities repel each other; high-quality housing does not generally arise next to industrial areas, and other activities cannot afford the high costs of the most desirable locations. New industrial areas develop in suburban locations since they require easy access, and outlying business districts may develop for the same reason.

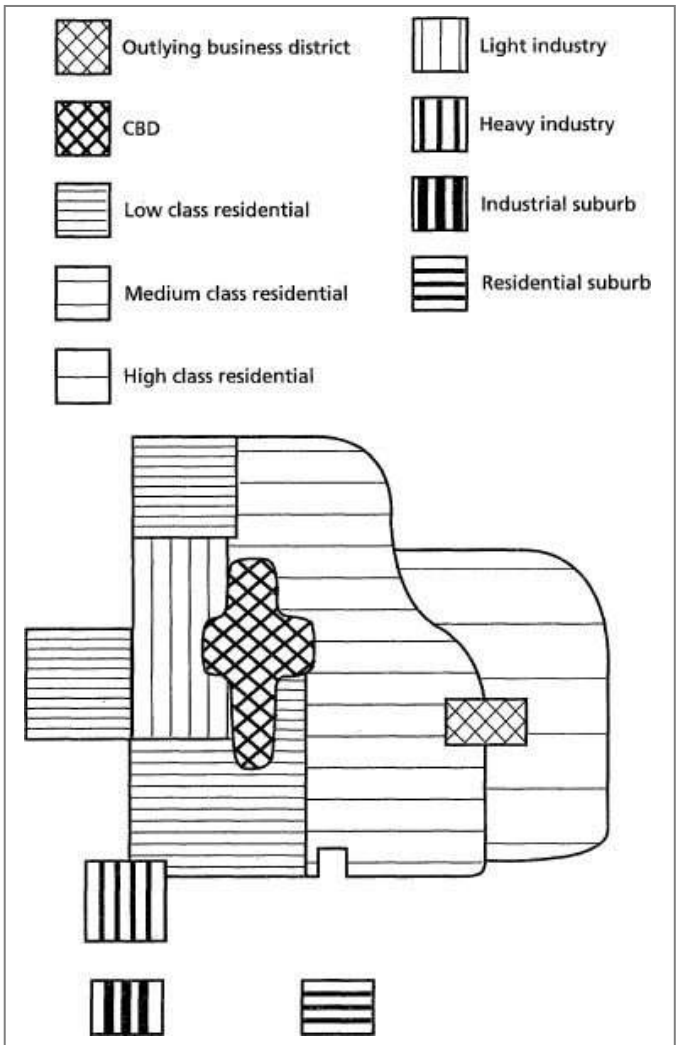


Figure: **Multiple Nuclei Theory** was advanced by C. D. Harris and E. L. Ullman

Sector Theory:

The view that housing areas in a city develop in sectors along the lines of communication, from the CBD outwards.

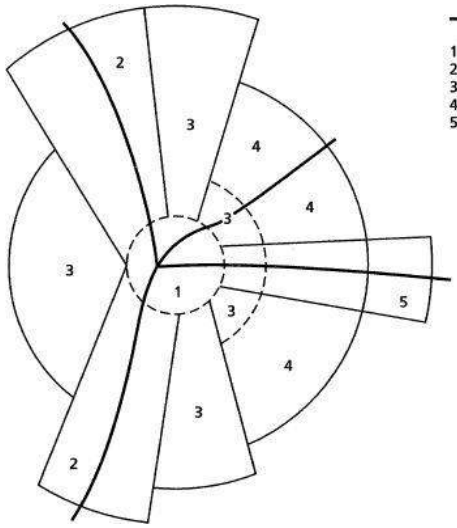


Figure: **Sector Theory** was advanced by H. Hoyt

High quality areas run along roads and also reflect the incidence of higher ground. Industrial sectors develop along canals and railways, away from high quality housing. Thus a high status residential area will spread out along the lines of the sector by the addition of new belts of housing beyond the outer arc of the city. Once contrasts in land use have developed in a sector near to the city, these contrasts will be perpetuated as the city grows. This theory was advanced by H. Hoyt (1939) as an alternative to Burgess' concentric model, and was based on residential rent patterns in the USA.

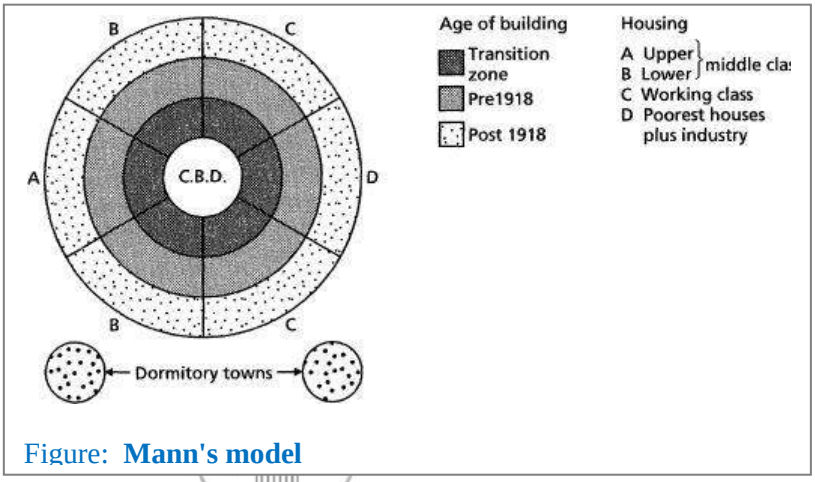


Figure: **Mann's model**

Mann's model

This model of British urban development, proposed by P. Mann (1965), combines the sector theory with the concentric zone model. Four basic sectors are postulated: middle class, lower middle class, working class, and lower working class. Each sector displays four zones. In each case, there is the CBD, the transitional zone, a zone of smaller houses, and the outermost zone made up of post-1918 housing.

Q.26 Solution: Plot area= 2hectare x 100 x 100 = 2 x 100 x 100 sq.m
Buildable area with 2 FAR = 2 x (2 x 100 x 100) sq.m

>Dandaka type of town plan provides for two main entrance gates and is generally adopted for the formation of small towns and villages, the village offices being located in the east.
>The female deity of the village or the chamadevata will generally be located outside the village and the male deities in the northern portion.

In the ancient texts such as Manasara, Silparatna, Mayamata and Viswakarma Vaastu Shastra, different types of plans for Pattana, Nagara and Grama were described. According to Manasara there are eight types of plans for designing towns. They are **Dandaka**, Sarvatobhadra, Nandyavartha, Padmaka, Swastika, Prastara, Karmuka and Chaturmukha.

Q15. Notes: To put it simply, U- Value is the measure of the rate of heat loss through a material. Thus in all aspects of home design one should strive for the lowest U- Values possible because the lower the U-value –the less heat that is needlessly escaping. So for example single glazed windows have a typical U -value of 5.6 while double glazed windows have a typical U-value of 2.8.
The calculation of U-values can be rather complex -it is measured as the amount of heat lost through a one square meter of the material for every degree difference in temperature either side of the material. It is indicated in units of Watts per Meter Squared per Degree Kelvin or W/m
2K. Note that Kelvin is used as the scale of temperature difference, but this is numerically equal to
oC. So for example, one square meter of a standard single glazed window will transmit about 5.6 watts of energy for each degree difference either side of the window or a U - Value
of 5.6. A double glazed window will be significantly better with a U-value of 2.8 i.e. only transmitting 2.8 watts of energy in similar conditions.

What is a U value?
A U value is a measure of heat loss in a building element such as a wall, floor or roof. It can also be referred to as an 'overall heat transfer co-efficient' and measures how well parts of a building transfer heat. This means that the higher the U value the worse the thermal performance of the building envelope. A low U value usually indicates high levels of insulation. They are useful as it is a way of predicting the composite behaviour of an entire building element rather than relying on the properties of individual materials.
Why use U values?

U values are important because they form the basis of any energy or carbon reduction standard. In practice, nearly every external building element has to comply with thermal standards that are expressed as a maximum U value. Knowledge of how to simply calculate U values at an early stage in the design process, avoids expensive re-working later on in a project. It allows the designer to test the feasibility of their project at an early stage to ensure it is fit for purpose and will comply with regulatory frameworks.
When to use U-values
U values are calculated at stages D onwards in the design process. A critical milestone in any building project is obtaining building regulation approval. For this a SAP calculation for housing or an SBEM procedure for non domestic work is obligatory. As part of this process, the build up of any external construction element must be specified and from this its U value can be derived.

Q16. Vicat's apparatus: a device for determining the normal consistency and time of setting of portland cements that consists of a rod weighing 300 grams, having a needle in each end, and supported in a frame with a graduated scale to measure the distance to which the needle penetrates the cement.

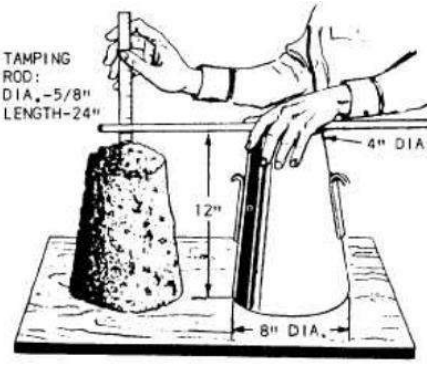


Figure: **Slump test.**


Figure: **Pcynometer**

The **concrete slump test** is an empirical test that measures the workability of fresh concrete.
More specifically, it measures the consistency of the concrete in that specific batch. This test is performed to check the consistency of freshly made concrete. Consistency is a term very closely related to workability. It is a term which describes the state of fresh concrete. It refers to the ease with which the concrete flows. It is used to indicate the degree of wetness. Workability of concrete is mainly affected by consistency i.e. wetter mixes will be more workable

17. The most fascinating part of the Pantheon is its giant dome, with its famous hole in the top (The eye of the Pantheon, or oculus). It is in perfect proportion with the Pantheon by the fact that the distance from the floor to the top of the dome is exactly equal to its diameter.

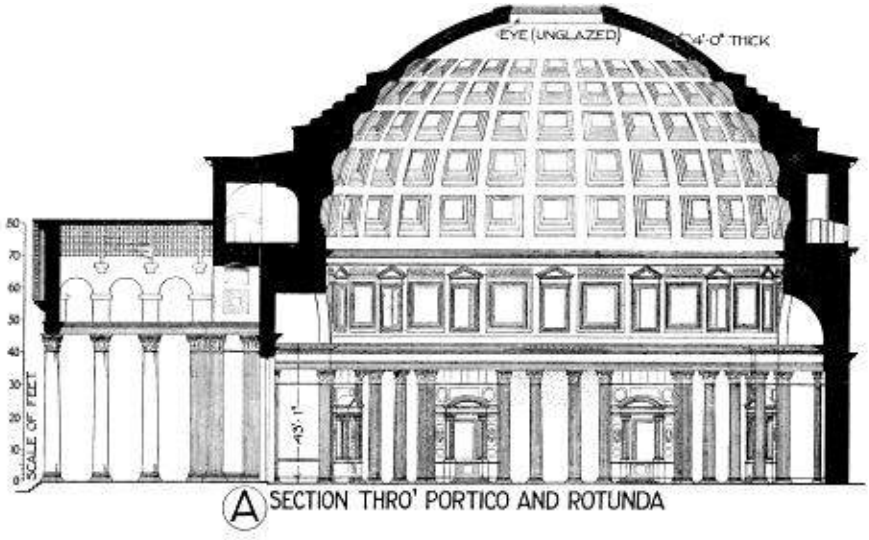


Figure: Section of Pantheon showing oculus.

The hole (oculus), 7.8 meters in diameter, is the only source of light and is the connection between the temple and the gods above. Rain occasionally fall through it, but the floor is slanted and drains the water if it manages to hit the floor. In practice, rain seldom falls inside the dome. The whole building stands on a 1.3 m high base which originally extended a further 7 metres in front of the colonnade. The building consists of two principal parts - the porch, which is very Classical Greek in presentation, and the circular main building which is much more Roman in style.

Scan here for further reading.

18. Building designed by J.A. Stein (An American Architect who made India his home)

Building designed by J.A. Stein: American international school • Gandhi-King Plaza • Triveni Kala Sangam. • Indian express tower • Lodhi Estate•Ford foundation head quarters • UNICEF building • India international centre • India Habitat centre

Building design by Anant Raje:

- Executive Management Centre at the Indian Institute of Management in Ahmedabad, India
- Indian Institute of Forest Management Bhopal, India
- The Indian Statistical Institute in New Delhi.
- Museum Of Minerals, Nagpur(unbuilt)
- Galbabhai Farmers' Training Institute in Banaskantha, Gujarat
- MAFCO wholesale market, Mumbai, India

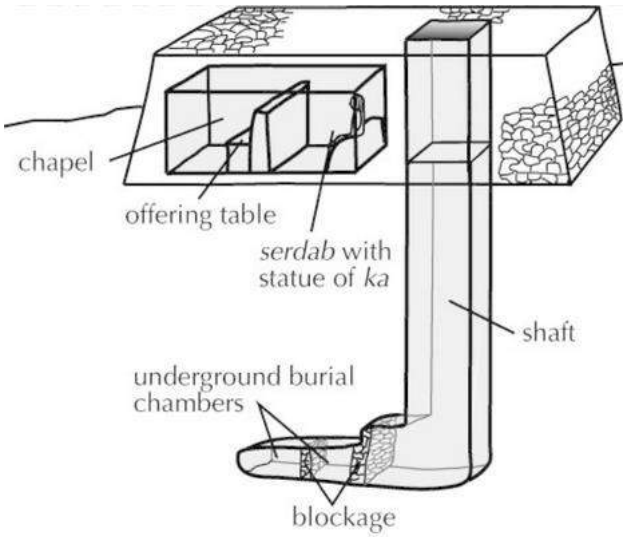


Figure: Mastaba • The first tombs were mastabas • They were flat roofed rectangular buildings made of bricks, with sloping sides that marked the burial site of many eminent Egyptians • The funeral chambers were underground.

19. Mihrab is a semicircular niche in the wall of a mosque that indicates the qibla; that is, the direction of the Kaaba in Mecca when praying.

Squinch, in architecture, a piece of construction used for filling in the upper angles of a square room so as to form a proper base to receive an octagonal or spherical dome. It was the primitive solution of this problem, the perfected one being eventually provided by the pendentive. Squinches may be formed by masonry built out from the angle in corbeled courses, by filling the corner with a vise placed diagonally, or by building an arch or a number of corbeled arches diagonally across the corner.

σ. As per the Statistics, individual σ cannot be added together. In order to determine Critical Path SD, we have to first find Variance of the Critical Path.

Variance (Critical Path) = Variance(A)+Variance(B) = 2.79 + 5.15 = 7.94
As per the Statistics, σ can be determined by taking Square Root of Variance.
σ (Critical Path) = Square root of (Var(A)+Var(B)) = Square root of 7.94 = 2.82 Answer.

SECTION B (50 marks)
PART II
20. Solution: First, calculate discharge rate of sewage.
Q_w = (100000*120 litres)/(24*3600 seconds) = 139 litres/seconds = 0.139 cu.m /sec
L_w = 40mg/lit (assumed)
Q_r = 1 cu.m/sec (given)
L_r = 0.8 mg/lit (given)

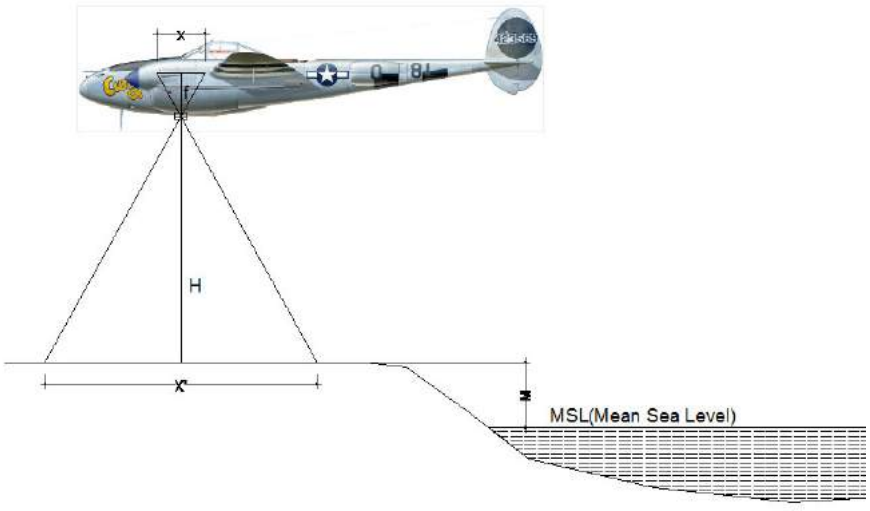
$$L_0 = \frac{Q_r L_r + Q_w L_w}{Q_r + Q_w}$$

Where :
L_0 = Ultimate BOD at the point of waste discharge
Q_r = Flow in the river upstream of the discharge
L_r = Ultimate BOD of the river wate r
Q_w = Flow of wastewate r from the discharge
L_w = Ultimate BOD in the discharged wastewate r

$$L_o = \frac{1\ \text{cu.}\frac{m}{sec}*0.8\frac{mg}{lit} + 0.139\frac{cum}{sec}*0.8\frac{mg}{lit}}{(1+0.139)\text{cum/sec}} = 0.8\ \text{mg/lit Answer}$$

23. Solution: *Given:* Coefficient of friction, **μ** = 0.2, Radius, **r** = 300m, Speed **v**, = 100 km/hr = 27.79m/sec
$v = \sqrt{rg\ Tan\theta}$
or, $Tan\theta = v^2/rg = (27.79)^2/300*9.8 = 0.26$
or, $\theta = 14.57°$ Answer

29. Solution: Here, $\frac{f}{H} = \frac{x}{X'}$ => $\frac{0.15m}{H} = \frac{1}{25000}$ => H = 25000*0.15m = 3750m (Flying height above mean ground level)
Flying height of the aircraft above mean sea level = 3750 +1200 = 4950m Answer.



END

2	Low air speed	**B**	Landscape (3)
3	Kinaesthetia	**C**	Colour (1)
4	Jantar Mantar	**D**	Raja Jai Singh (4)
5	Flying Buttress	**E**	Kata Thermometer (2)
6	Hypostyle Hall	**F**	Egyptian (6)
7	Humidity	**G**	Heliometer (8)
8	Solar radiation	**H**	Microbar (9)
9	Sound Pressure	**I**	Hygrograph (7)
10	Patina	**J**	Corrosion (10)

Q.3 Indicate the following statement as TRUE or FALSE.

3.1 Over compaction of concrete is bad as it causes disintegration. TRUE

3.2 Zero hardness water is unsuitable for distribution because it is likely to be corrosive. TRUE

3.3 " Mulguf' is a ventilating device used first by the Romans. FALSE

3.4 Aerobic bacteria require oxygen for their existence and they thrive in the presence of light. TRUE

3.5 Laurie Baker is famous for slum upgradation scheme in India. FALSE

Q.4 Fill in the blanks:

4.1 The purpose of vibration is to expel voids and air bubbles in the concrete mass entrapped during mixing.

4.2 In a computer system printer is an external device.

4.3 Floppy diskette is an external storage device.

4.4 In a post-tensioned beams, the tendons are not initially embedded to the concrete.

4.5 Amoeba is an organism associated with the biological treatment of waste water.

4.6 Sun light facilitates stack effect by warming the air and causing gentle convection current.

4.7 Bhilai is an example of Steel Town.

4.8 New Delhi is an example of Colonial Town.

4.9 Notre-Dame is an example of Gothic architecture.

4.10 Ratio of built up area to plot area is defined as FAR

Q.5 What do the following abbreviations stand for:

5.1 INTACH : Indian National Trust for Art and Cultural Heritage

5.2 N.B.O: National Building Organization

5.3 E.W.S: Economically Weaker Section

5.4 T.C.P.O: Town and Country Planning Organization

5.5 FORTRAN: Formula Translation

Q9.1 Solution: Current Demand = Population / Household size = 2,15,000 / 5 = 43,000 Houses

Housing Demand in 2001 = Population / Household size = 2,70, 000 / 4.5 = 60,000 Houses

Demand difference = 60,000 – 43,000 = 17,000 Houses

Initially we needed 43,000 houses but we had only 39,000. So, Initial Shortage = 43,000 – 39,000 = 4,000 Houses

Depleted Houses = 3,500 Houses

So, total demand = Demand difference + Initial shortage + Depleted houses = 17,000 + 4,000 + 3,500 = 24,500 Answer

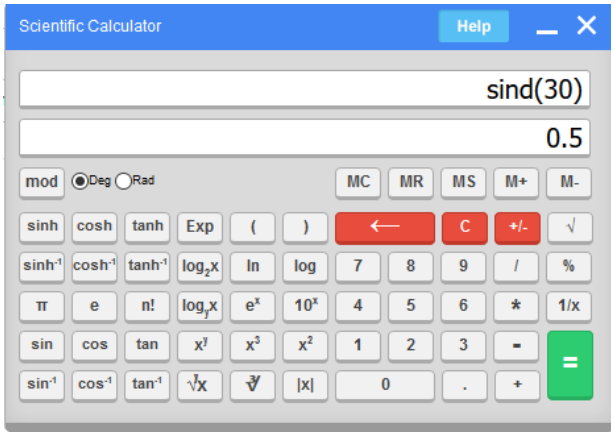
Q10.1 Solution: 30% of x = 2400 => $\frac{30}{100} * x = 2400$ => $\frac{30*x}{100} = 2400$ => $30*x = 240000$

=> x = $\frac{240000}{30}$ = 8000 hectares (It is total urban area)

As per question, 70% of total urban area is developed land = 70% of 8000 = $\frac{560000}{100}$ hectare = 5600 hectare

As per question, 50% of 5600 hectare is residential landuse = 2800 hectare *Answer*

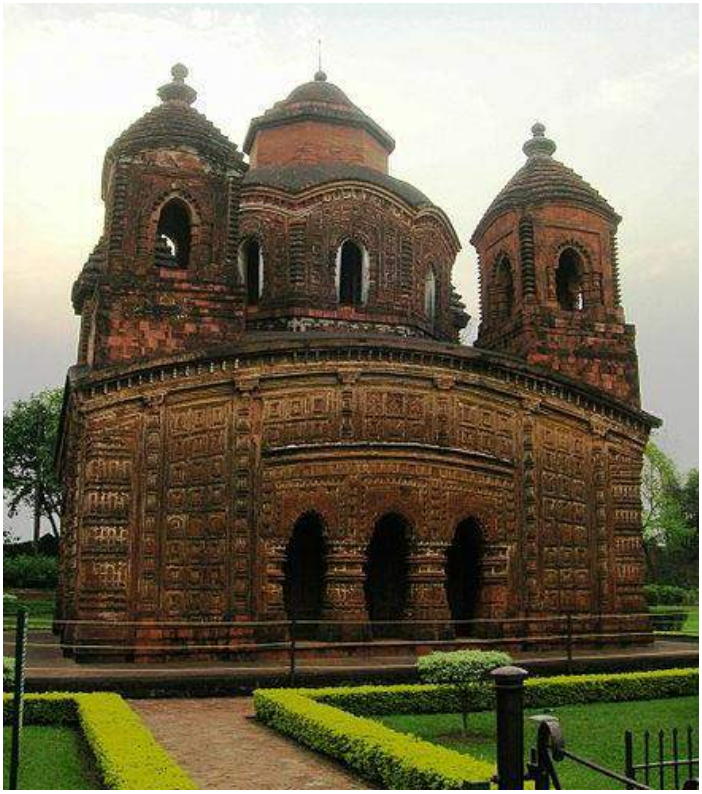
Population density = $\frac{\text{Population}}{\text{Total Area}} = \frac{2,00,000}{8000}$ = 25 person per hectare *Answer*



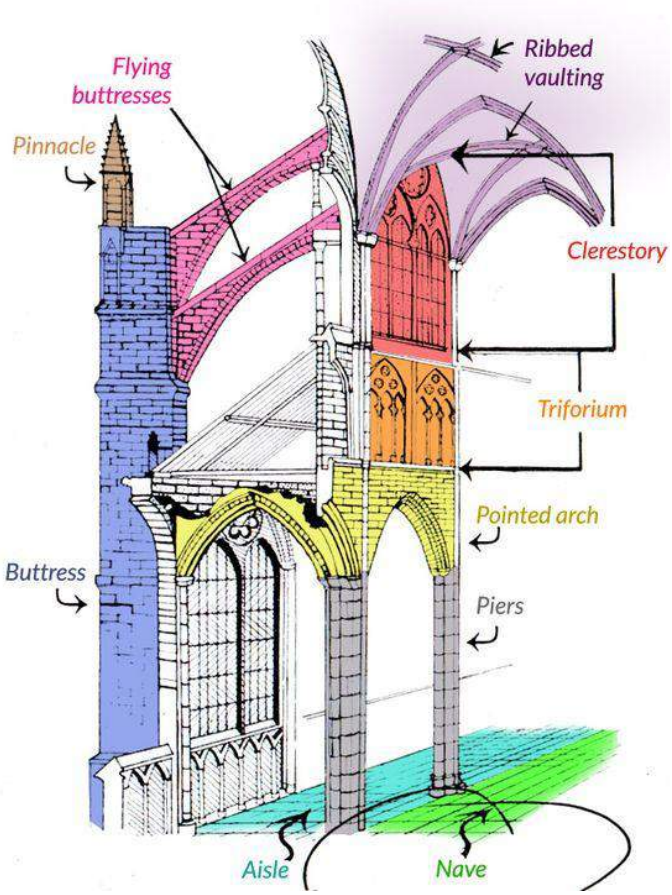
GATE 2018: Visit the official GATE website and appear for a Mock Test to be familiar with function of the 'Scientific Calculator' and UI.

GATE 2018: Classification of color.
Primary Colors: Red, yellow and blue
Secondary Colors: Green, orange and purple
Tertiary Colors: Yellow-orange, red-orange, red-purple, blue-purple, blue-green & yellow-green

GATE 2017: Polyalthia Longifolia. It's native name is Ashok



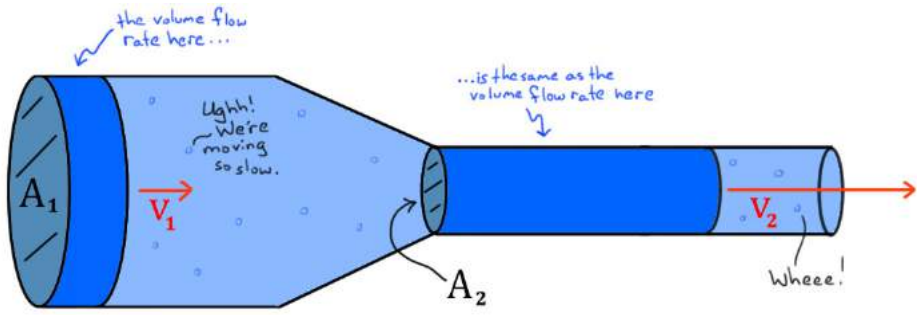
GATE 2018: Shyamrai Temple, Bishnupur (Pancha Ratna Temple)



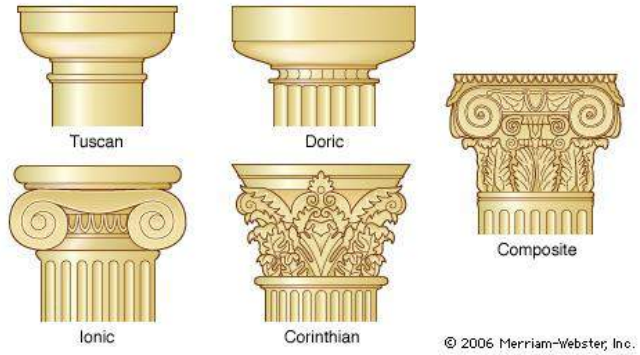
GATE 2018: The flying buttress is composed of an arched structure that extends from the upper portion of a wall to a pier of great mass, in order to convey to the ground the lateral forces that push a wall outwards, which are forces that arise from vaulted ceilings of stone and from wind-loading on roofs.

GATE 2018: S. Maria del Fiore Cathedral, Florence, Italy : Construction begun in 1296 in the Gothic style with the design of **Arnolfo di Cambio** and completed structurally in 1436 with the dome engineered by **Filippo Brunelleschi.**

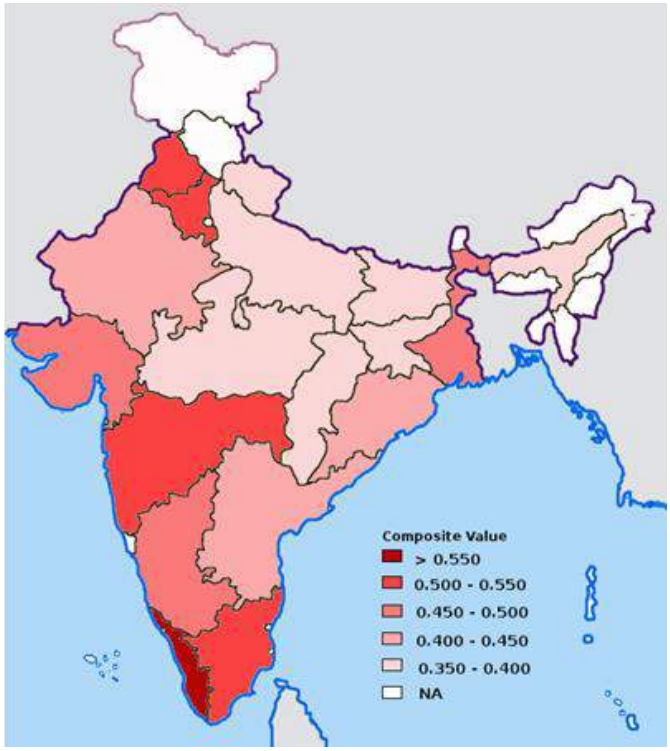
GATE 2017: Victoria Memorial, Kolkata. Made of marble.



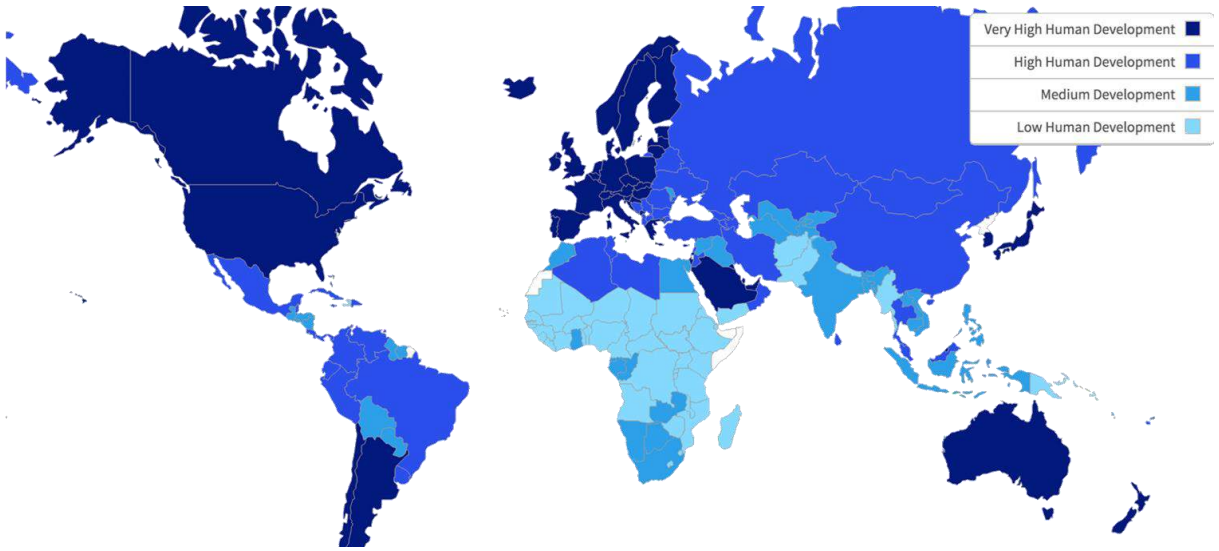
GATE 2017: Law of continuity, $V_1 * A_1 = V_2 * A_2$



GATE 2017: The three **orders** of architecture—the Doric, Ionic, and Corinthian—originated in Greece. To these the Romans added, in practice if not in name, the **Tuscan**, which they made simpler than Doric, and the **Composite**, which was more ornamental than the Corinthian.



GATE 2016: Human Development Index (HDI): India, statewise distribution.



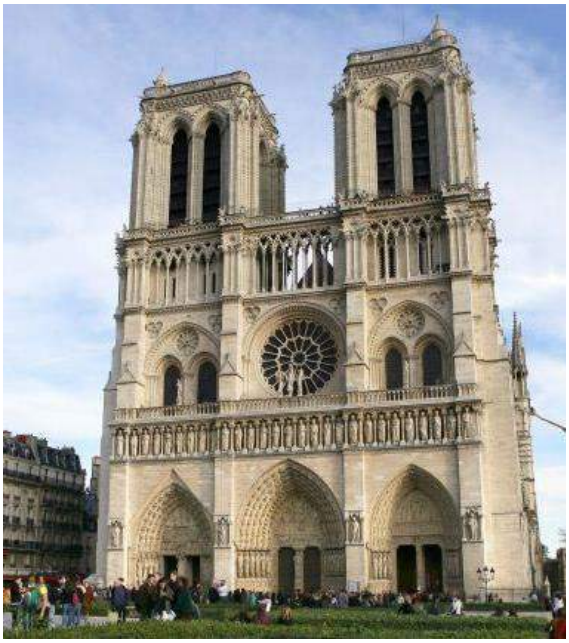
GATE 2016: Human Development Index (HDI): Worldwide

Figure: Bird's eye view, **Trafalgar Square, London**

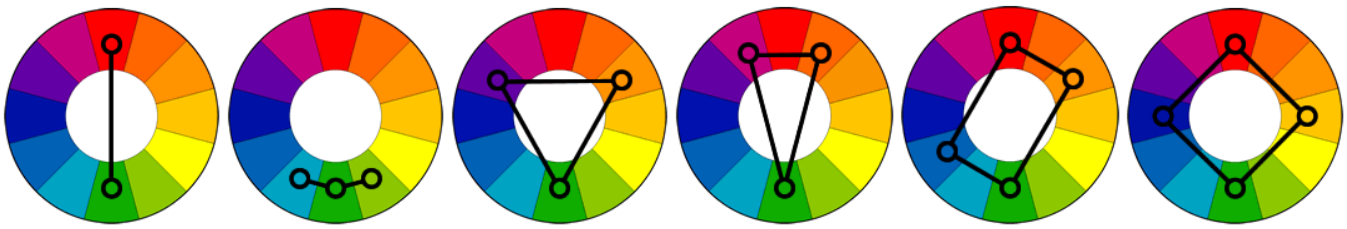
GATE 2015: Konark Wheel, **The Sun Temple** of Konark. Dedicated to Sun God

GATE 2015: **The Temple of Karnak, Egypt**

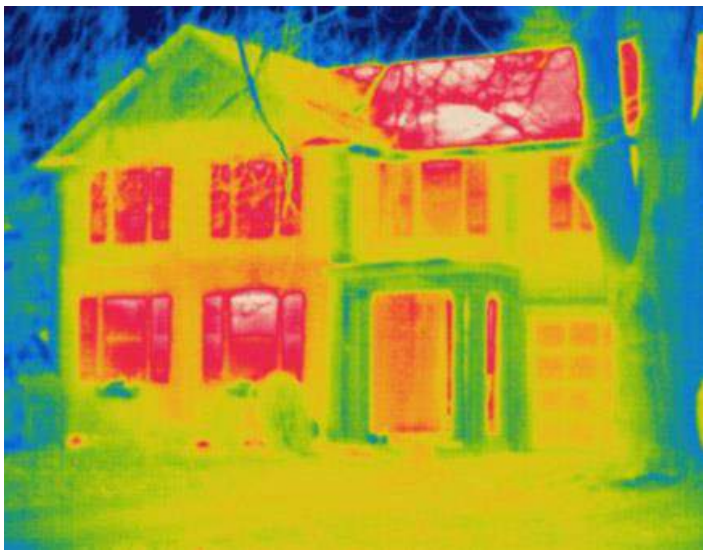
GATE 2015: Hall of Pillars, Meenakshi Temple, Madurai.



GATE 2015: Notre Dame Cathedral, Paris. Rose window you can see here.

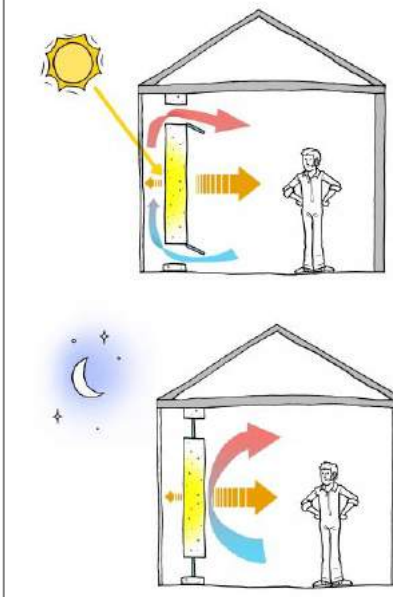


GATE 2015: Complementary, Analogous, Analogous, Triad, Split-Complementary, Rectangle (tetradic), Square (read serially)

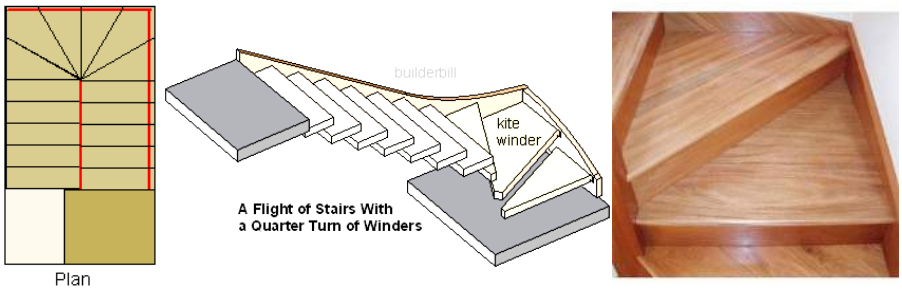


GATE 2015: Infrared mapping. Most household heat is lost through the windows and roof as shown in the figure.

GATE 2015: Stucco work, Meenakshi Temple, Madurai.



GATE 2015: **Trombe Walls**



GATE 2014: Example of Winders

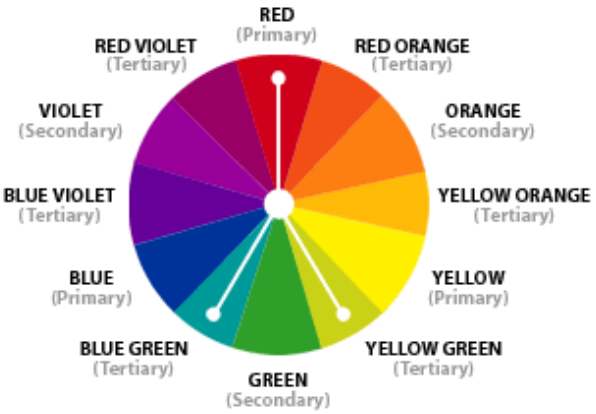
GATE 2014: **Gulmohar (*Delonix regia*)**

GATE 2015: *Neem* (Azadarachta indica)

GATE 2014: **Topiary** , a horticultural practice.

GATE 2013: Shisham, *Dalbergia sissoo*

GATE 2002: Kandariya is renowned for its Nagara-style architecture (characterized by a central tower), as well as its sculpture. Khajuraho was formerly the religious capital of the Chandela Rajputs.



GATE 2002: The **split-complementary** color **scheme** is a variation of the **complementary** color **scheme**. In addition to the base color, it uses the two **colors** adjacent to its complement.

GATE 1997: The Aranya Project in Indore is planned by B.V. Doshi

Shikara Vimana

GATE 1992: Shikhara has a curving shape while vimana has a pyramidal-like structure

GATE 1991: St. Louis Gateway Arch *by Eero Saarinen*

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