

# GATE QUESTION BANK

# BLACK & WHITE

Q&A *with* ESSENTIAL NOTES  
For Architecture & Planning

**BETTER CONTENT AT  
BEST PRICE**



By Faculty of Architecture



**GATE ARCHITECTURE.com**

**Volume**

**1 & 2**

With  
**LATEST  
UPDATE**

This is a consolidated cover page design

# Unique Features

## ★ The Question Bank in 2 Volumes

Easy to handle.

Easy to buy with friends by sharing the cost.

Easy to study in groups for best result.

## ★ Black and White prints

For cost saving. However, it also includes 30+ pages of color print for better understanding of the subject, for example, color theory, land-use color code, flower & plants, and other figures that loose essential information when not printed in color.

## ★ Extensive coverage

Question Paper of GATE since 1991 to 2021 (31 Years)

## ★ Essential Notes

Notes has been provided not just for answering a question but also for extra coverage!

## ★ Comprehensive content

With total 468 pages. And it can be added further for upgrade without prior information!

## ★ QR-coded text

You can scan QR-code printed in the book from your phone for extra reading related of the subject.

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Volume

1

Volume

2

## Preface

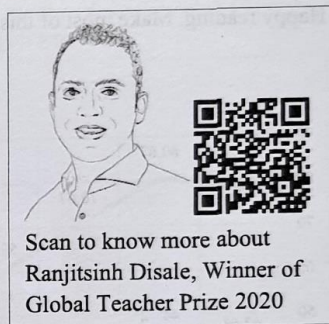
**Complete Syllabus through Question Bank:** The best way to prepare for an exam like GATE is through a comprehensive study of previous-year question papers. It takes less time to cover most part of the syllabus. Solving the previous GATE questions helps aspirants to understand the exam pattern, knowing 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 is 'Japanese Garden'. It is best to support the answer with additional 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 from a related topic, you should answer it if you have gone through additional studies or notes.

**Essential 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 and answer itself.

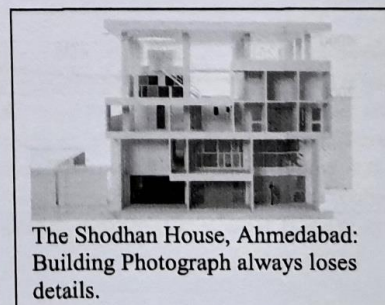
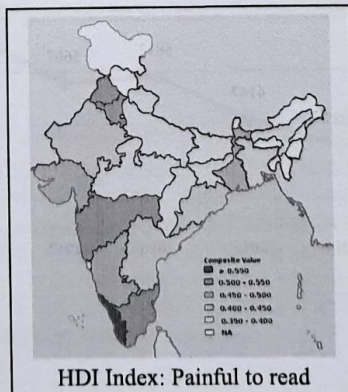
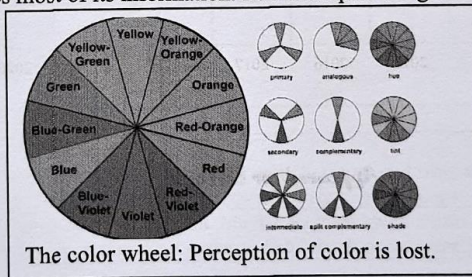
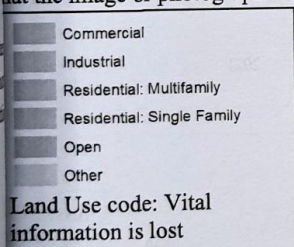
**QR-code based book:** We have been using QR-code based deep learning for our GATE reference books since 2015. It gave us encouragement when it came to news that a teacher **Ranjitsinh Disale** won \$1mn Global Teacher Prize 2020 for using QR-codes based book for teaching in school.

This book is very concise. It contains a very exhaustive source of reference material for a deep understanding of the subject. So, it has QR-codes. Scan the code for further studies if you need. There are many QR code scanners available on Google Play Store or apple App Store. We recommend, you scan the QR-codes with the app that comes with your phone itself. Installing the 'QR Code Reader' app from the Google Play Store or the Apple App Store may contain advertisement that could be irritating and downgrade reading experience. Some phone can scan QR-codes directly with its camera itself without any app!



**Complete Package:** This question bank contains question papers of last 31 years from 2021 to 1991. All it makes it the complete Question Bank. When you go through all these, you will get an idea of 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.

**Black & White Prints:** 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:



## Table of Contents

	Page range	No. of pages	Remarks
Preface	~	2	
Memory Techniques	~	6	
Syllabus for GATE 2022	~	3	
<b>Question Bank ~ Volume 1</b>			
GATE 2021 Q&A with Essential Notes	1 ~ 30	30	
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GATE 1995 Q&A with Essential Notes	384 ~ 390	06	
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GATE 1993 Q&A with Essential Notes	398 ~ 403	06	
GATE 1992 Q&A with Essential Notes	404 ~ 409	06	
GATE 1991 Q&A with Essential Notes	410 ~ 415	07	
<b>Color Illustrations</b>			
	416 ~ 452	37	
<b>Total</b>		<b>468</b>	

In pursuit of constantly improving this book, we would delete or add contents without prior information!

Please note that this is not the exact Black & White print version of the color printed Question Bank that comes in 4 volumes. This is exclusively prepared for conciseness yet with detailed explanation. A 30+ pages of color print of illustrations has been included for better understanding of the subject.

Architecture and Planning (AR): New Pattern

New

The Paper contains General Aptitude (GA) section (15 Marks) as applicable for all papers of GATE 2022. The Paper consists of two parts covering the syllabus: Part A (60 marks) and Part B (25 marks).  
**Part A** is compulsory for all the candidates.  
**Part B** contains two optional sections: Part B1 (Architecture) and Part B2 (Planning).  
 Candidates have to choose any one of these during the examination! (Part B1 or Part B2)

Part A: General

Section 1: Architecture, Planning and Design

Architectural Graphics; Visual composition in 2D and 3D; Computer application in Architecture and Planning; Anthropometrics; Organization of space; Circulation- horizontal and vertical; Space Standards; Universal design; Building byelaws; Codes and standards;

Section 2: Construction and Management

Project management techniques e.g. PERT, CPM etc.; Estimation and Specification; Professional practice and ethics; Form and Structure; Principles and design of disaster resistant structures; Temporary structures for rehabilitation;

Section 3: Environmental Planning and Design

Natural and man-made ecosystem; Ecological principles; Environmental considerations in Planning and design; Environmental pollution- types, causes, controls and abatement strategies; Sustainable development, goals and strategies; Climate change and environment; Climate responsive design;

Section 4: Urban Design, landscape and Conservation

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

Section 5: Planning process

Salient concepts, theories and principles of urban planning; concepts of cities - Eco-City, Smart City; Concepts and theories by trendsetting planners and designers; Ekistics; Urban sociology; Social, Economic and environmental cost benefit analysis; Methods of non-spatial and spatial data analysis; Development guidelines such as URDPFI;

Section 6: Housing

Housing typologies; Concepts, principles and examples of neighbourhood; Residential densities; Affordable Housing; Real estate valuation;

Section 7: Services and Infrastructure

Firefighting Systems; Building Safety and Security systems; Building Management 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; Land-use – transportation - urban form inter-relationships; Design of roads, intersections, grade separators and parking areas; Hierarchy of roads and level of service; Para-transits and other modes of transportation, Pedestrian and slow moving traffic planning;

Part B1: Architecture

Section B1.1: History and Contemporary Architecture

Principles of Art and Architecture; World History of Architecture: Egyptian, Greco-Roman classical period, Byzantine, Gothic, Renaissance, Baroque-Rococo, etc.; Recent trends in Contemporary Architecture: Art nouveau, Art Deco, Eclecticism, International styles, Post Modernism, Deconstruction in architecture, etc.; Influence of Modern art and Design in Architecture; Indian vernacular and traditional Architecture, Oriental Architecture; Works of renowned national and international architects;

Section B1.2: Building Construction and Structural systems

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Construction planning and equipment; Building material characteristics and applications; Principles of strength of materials; Alternative building materials; Foundations; Design of structural elements with different materials; Elastic and Limit State design; Structural systems; Principles of Pre-stressing; High Rise and Long Span structures, gravity and lateral resisting systems;

Section B1.3: Building Services and Sustainability

Solar architecture; Thermal, visual and acoustic comfort in built environments; Natural and Mechanical ventilation in buildings; Air-Conditioning systems; Sustainable building strategies; Building Performance Simulation and Evaluation; Intelligent Buildings;

Water supply; Sewerage and drainage system; Principles  
 Part B2: Planning  
 Section B2.1: Regional and Settlement  
 Regional delineation; settlement hierarchy  
 and Schemes; Slums, Squatters and special areas and needs;  
 Section B2.2: Planning Techniques  
 Application of GIS and Remote Sensing  
 Topographical, Land use and Socio-economic  
 planning; Graphic presentation of planning  
 implementation – Land Acquisition, Economics; Management of Infrastructure  
 Section B2.3: Infrastructure Planning  
 Process and Principles of Transport survey methods, Traffic flow Analysis in urban areas; Mass transportation System Network.  
 General Aptitude (15 marks)  
 Verbal Aptitude  
 Basic English grammar: tenses, and Basic vocabulary: words, idioms,  
 Quantitative Aptitude  
 Data interpretation: data graphs (tables) Numerical computation and combinations, and series Mensuration  
 Analytical Aptitude  
 Logic: deduction and induction,  
 Spatial Aptitude  
 Transformation of shapes: translation and 2 and 3 dimensions  
 Sample questions  
 Verbal Aptitude  
 Q1. Out of the following four sentences  
 (A) I will not leave the place until  
 (B) I will not leave the place until  
 (C) I will not leave the place until  
 (D) I will not leave the place until  
 Q2. Indian currency notes show  
 languages. If this is not an indication  
 Which of the following can be located  
 (A) India is a country of exactly  
 (B) Linguistic pluralism is the order  
 (C) Indian currency notes have  
 (D) Linguistic pluralism is strong  
 Q3. The timely crowd demanded  
 (A) hanged (B) hanging  
 Q4. Archimedes said, "Give me  
 The sentence above is an example of  
 (A) figurative (B) collateral  
 Quantitative Aptitude  
 Q5. The bar graph in Panel (a) shows  
 females in 2001 and 2011 are  
 percentage increase in the number

General Aptitude (GA)

Q1. - Q5. Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: - 1/3).

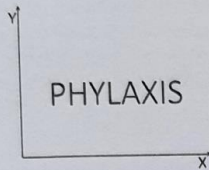
- Q1. (i) Arun and Aparna are here.  
(iii) Arun's families is here.

- (ii) Arun and Aparna is here.  
(iv) Arun's family is here.

Which of the above sentences are grammatically CORRECT?

- (A) (i) and (ii) (B) (i) and (iv) (C) (ii) and (iv) (D) (iii) and (iv)

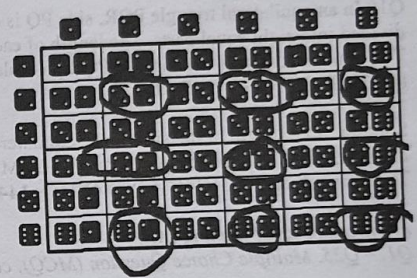
Q2. The mirror image of the below text about the x-axis is



(A)	PHYLAXIS
(B)	PHYLAXIS
(C)	PHYLAXIS
(D)	PHYLAXIS

Q3. Two identical cube shaped dice each with faces numbered 1 to 6 are rolled simultaneously. The probability that an even number is rolled out on each dice is: (A) 1/36 (B) 1/12 (C) 1/8 (D) 1/4

Solution: Required probability  
= P(both are even)  
= P(first is even) \* P(second is even)  
= (3/6)\*(3/6) = (1/2)\*(1/2)  
= 1/4 Answer



Q4. ⊕ and ⊙ are two operators on numbers p and q such that p ⊙ q = p - q, and p ⊕ q = p x q.

Then, (9 ⊙ (6 ⊕ 7)) ⊙ (7 ⊕ (6 ⊙ 5)) = (A) 40 (B) -26 (C) -33 (D) -40

Solution: [9 - (6 x 7)] - [7 x 1] = -33 - 7 = -40 Answer

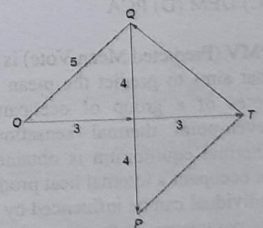
Q5. Four persons P, Q, R and S are to be seated in a row. R should not be seated at the second position from the left end of the row. The number of distinct seating arrangements possible is: (A) 6 (B) 9 (C) 18 (D) 24

Solution: Number of arrangements = 3 x 3! = 3 x (3 x 2 x 1) = 18 Answer

Q6. - Q10. Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: - 2/3).

Q6. On a planar field, you travelled 3 units East from a point O. Next you travelled 4 units South to arrive at point P. Then you travelled from P in the North-East direction such that you arrive at a point that is 6 units East of point O. Next, you travelled in the North-West direction, so that you arrive at point Q that is 8 units North of point P.

The distance of point Q to point O, in the same units, should be \_\_\_\_\_.  
(A) 3 (B) 4 (C) 5 (D) 6



Q7. The author said, "Musicians rehearse before their concerts. Actors rehearse their roles before the opening of a new play. On the other hand, I find it strange that many public speakers think they can just walk on to the stage and start speaking. In my opinion, it is no less important for public speakers to rehearse their talks."

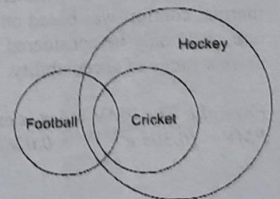
Based on the above passage, which one of the following is TRUE?

- (A) The author is of the opinion that rehearsing is important for musicians, actors and public speakers.  
(B) The author is of the opinion that rehearsing is less important for public speakers than for musicians and actors.  
(C) The author is of the opinion that rehearsing is more important only for musicians than public speakers.  
(D) The author is of the opinion that rehearsal is more important for actors than musicians.

Q8. Statement 1: Some football players play cricket.

Statement 2: All cricket players play hockey.

Among the options given below, the statement that logically follows from the two statements 1 and 2 above, is:



- (A)  
(B)  
(C)  
(D)

Where,

$PMV = \text{Predicted Mean Vote Index}$

$M = \text{metabolic rate}$

$L = \text{thermal load - defined as the difference between the internal heat production and the heat loss to the actual environment - for a person at comfort skin temperature and evaporative heat loss by sweating at the actual activity level}$

What is PPD?

Through PMV, we can predict the thermal sensation of a population, but this doesn't paint the whole picture. We also need to consider the level of satisfaction of the occupants in a space, to get a more holistic idea of if and how thermal comfort can be achieved. For this, Fanger developed another equation to relate the PMV to the predicted percentage of dissatisfied (PPD).

(Source: <https://www.simscale.com/blog/2019/09/what-is-pmv-ppd/>  
[https://www.engineeringtoolbox.com/predicted-mean-vote-index-pmv-d\\_1631.html](https://www.engineeringtoolbox.com/predicted-mean-vote-index-pmv-d_1631.html))

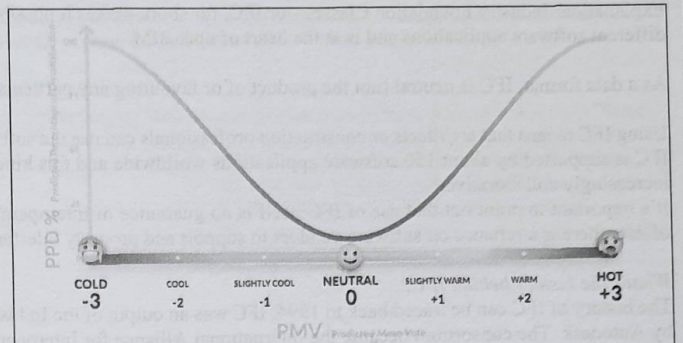


Figure: Once the PMV is calculated, the PPD, or index that establishes a quantitative prediction of the percentage of thermally dissatisfied occupants (i.e., too warm or too cold), can be determined. PPD essentially gives the percentage of people predicted to experience local discomfort. The main factors causing local discomfort are unwanted cooling or heating of an occupant's body. Common contributing factors are drafts, abnormally high vertical temperature differences between the ankles and head, and/or floor temperature.

Q3. Indian satellite sensor that can be used for very high resolution mapping of urban areas is

- (A) LANDSAT (B) CARTOSAT (C) RESOURCESAT (D) MODIS (Marks to all)

Cartosat series of satellites launched by ISRO (Indian Space Research Organization) with high-resolution imaging sensors are primarily intended for applications in the areas of cartography and large-scale mapping. Some of the important applications include monitoring of irrigation infrastructure created under Accelerated Irrigation Benefit Program, NUIM (National Urban Information System), Topo-thematic mapping at 1:10,000 scale, Urban Infrastructure planning, and many State level Geospatial applications. Cartosat-3 is a third-generation agile advanced earth observation satellite with high-resolution imaging capability. Developed by the ISRO, it will replace the IRS series. Cartosat-3 has a panchromatic resolution of 0.25 metres making it the imaging satellite with highest resolution and Mx of 1 metre with a high-quality resolution, which is a major improvement from the previous payloads in the Cartosat series.

(Source: <https://www.isro.gov.in>, <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/cartosat>, <https://www.business-standard.com>)

Q4. What is the smallest entity of raster data used in GIS?

- (A) Line (B) Pixel (C) Point (D) Polygon

Explanation: Line, Point and Polygon are vector data used in GIS and AutoCad.

Q5. The correct sequence of stages during firing/burning of bricks is

- (A) Dehydration – Oxidation – Vitrification – Cooling.  
(B) Vitrification – Dehydration – Oxidation – Cooling.  
(C) Oxidation – Dehydration – Vitrification – Cooling.  
(D) Cooling – Oxidation – Vitrification – Dehydration.

Burning of bricks is the last stage in the manufacturing of bricks, which comprises four stages.

(a) **Dehydration:** It is completed with the temperature range of 425 to 750°. Bricks heated to this temperature lose all the free water and most of the water of crystallization.

(b) **Oxidation:** It also starts within the above range or temperature and is completed at about 900°C. All the organic matter in the brick-earth gets oxidized; carbon and Sulphur are eliminated as oxidized. The fluxes (lime, magnesia and iron) also become reactive at this temperature. The brick acquires the red color due to oxidation iron in the clays.

(c) **Vitrification:** It is the extreme reaction that takes place from 900°C to 1100°C or so. The constituents of brick clay, that is alumina and clay, start softening in the presence of fluxes and getting bound together firmly.

In fact, this is the change which makes a brick a strong and hard unit. But when the brick is heated to the extreme temperature of vitrification, the fluxes may actually cause considerable softening of the essential components of the brick earth. At that stage, the brick may lose even its original shape and get distorted at edges and corners. Hence ordinary, building bricks are not heated to very high vitrifying temperatures.

(d) **Cooling:** In this stage of manufacturing of bricks, the burnt bricks are placed for some time to be cooled before using it in the construction. (Source: <https://civilseek.com/manufacturing-of-bricks/>)

Q6. Industry Foundation Classes (IFC) in BIM is

- (A) a module used to improve energy savings.  
(B) an algorithm related to the precision of the BIM model.  
(C) a program based on Bezier Splines.  
(D) an object oriented data model to facilitate interoperability.



YouTube





What is IFC



9	EWEH	-	Taiwan	1999
10	Eco-Quantum	-	Netherlands	1999
11	CG	Green Globes	Canada	2000
12	BEAT	Building Evaluation Assessment Tool	Denmark	2000
13	Ecoprofil	Ökoprofil	Norway	2000
14	CASBEE	Comprehensive Assessment System for Building Environmental Efficiency	Japan	2001
15	CEPAS	Comprehensive Environmental Performance Assessment Scheme	Hong Kong	2002
16	KGBC	Korea Green Building Certification System	Korea	2002
17	GS	Green Star	Australia	2003
18	GRIHA	Green Rating for Integrated Habitat Assessment	India	2004
19	HQE	Haute Qualite Environment	France	2005
20	Si-5281	Israel Standard 5281: Building with Reduced Environmental Impact	Israel	2005
21	GM	Green mark	Singapore	2005
22	LBC	Living Building Challenge	America	2006
24	GPR	Green Point Rated	America	2006
24	ASGB	Assessment Standard for Green Building	China	2006
25	DGNB	Deutsche Gesellschaft Fur Nachhaltiges Bauen	Germany	2006
26	CSH	Code for Sustainable Homes	UK	2006
27	EPRS	Estidama Pearl Rating System	Abu Dhabi	2007
28	SICES	Sustainable Building Rating Tool/Sistema de Calificación de Edificación Sustentable	Mexico	2008
29	NGBS	National Green Building Standard	America	2008
30	AQUA-HQE	Alta Qualidade Ambientale	Brasil	2008
31	LiderA	The Sistema de Acaliacao da Sustentabilidade (Certification System of Environmentally Sustainable Construction)	Portugal	2008
32	ITACA Protocol	Protocollo Itaca	Italy	2009
33	GBI	Green Building Index	Malaysia	2009
34	BERDE	Building for Ecologically Responsive Design Excellence	Philippine	2009
35	GSAS	Global Sustainability Assessment System	Qatar	2009
36	VERDE	Herramienta VERDE	Spain	2009
37	GPRS	Green Pyramid Rating System Levels	Egypt	2010
38	LOTUS	-	Vietnam	2010
39	GREENSHIP	-	Indonesia	2010
40	TREES	Thai's Rating of Energy and Environmental Sustainability	Thailand	2010
41	BNB	Assessment System for Sustainable Building	Germany	2010
42	ARZ BRS	ARZ Building Rating System	Lebanon	2012
43	EDGE	Excellence in Design for Greater Efficiencies	America	2014
44	WELL	-	America	2014

Source: Yinqi Zhang, et al. 2019. A Survey of the Status and Challenges of Green Building Development in Various Countries, MDPI

Q27. Match the buildings in Group I with their corresponding architect in Group II. Group I P Q R S Group II

Group I				
				
P	Q	R	S	
Group II				
(1) Renzo Piano	(2) Daniel Libeskind	(3) David Childs	(4) Frank Owen Gehry	(5) Norman Foster

(A) P-4, Q-3, R-1, S-2 (B) P-2, Q-4, R-2, S-5 (C) P-3, Q-5, R-4, S-1 (D) P-2, Q-3, R-4, S-5

Country	Year
UK	1999
Canada	2000
US	2000
Finland	2001
Hong Kong	2002
Sweden	2002
Canada	2003
Australia	2003



ard building, London by Renzo  
used gives the building a lightness

known when in 1971, they saw  
in the high-profile job to design  
s gone on to become one of the wor  
ical – featuring moving floors and g  
f these original ideas were lost. Br  
ached and replaced through its life  
um and cinemas, the Pompidou Ce  
brightly coloured facade, the cent



Museum of American Art, New York  
Nic Lehoux4. The Menil Collection, Houston

The 37,000m<sup>2</sup> project, which includes exhibition space, research spaces, an aquarium and a planetarium, is designed as if a piece of park has been lifted up out of the ground. Its living roof undulates into a series of domes, marking out the various spaces beneath, and contributing to the natural movement of air through the building.

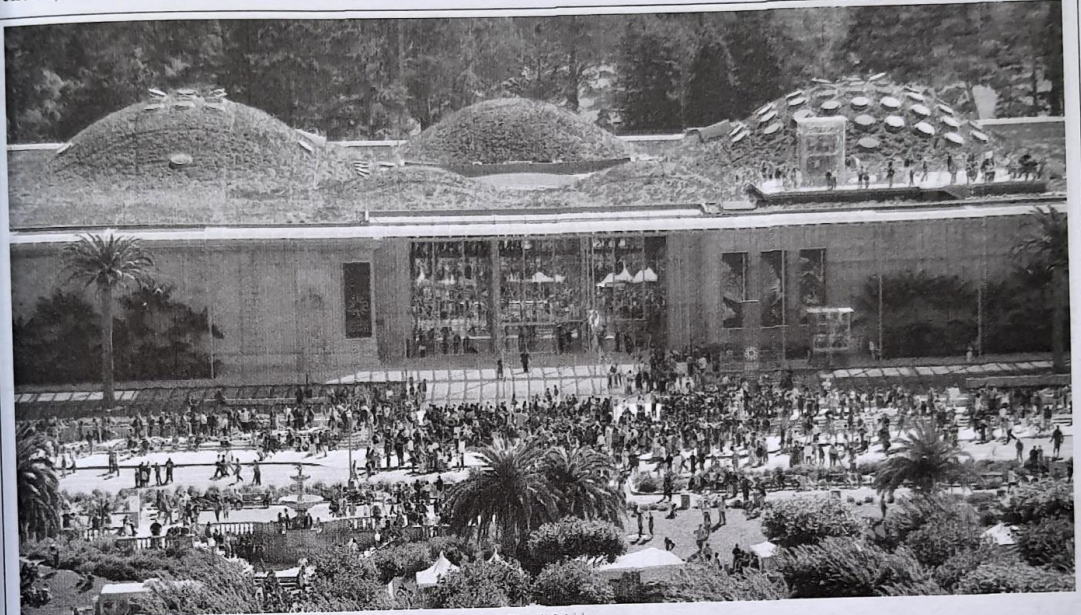


Figure: California Academy of Sciences, 2008. Photography: Shunji Ishida.

**Centro Botin, Santander (2017)**

Located in the Spanish city of Santander, the Centro Botin is a space for art, culture and education, and is Piano's first building in Spain. The 10,000m<sup>2</sup> project is split across two D-shaped blocks joined by an elevated glass and steel walkway that cantilevers out over the sea. The building is clad in more than 280,000 round ceramic tiles, which reflect the sunlight and the sea.

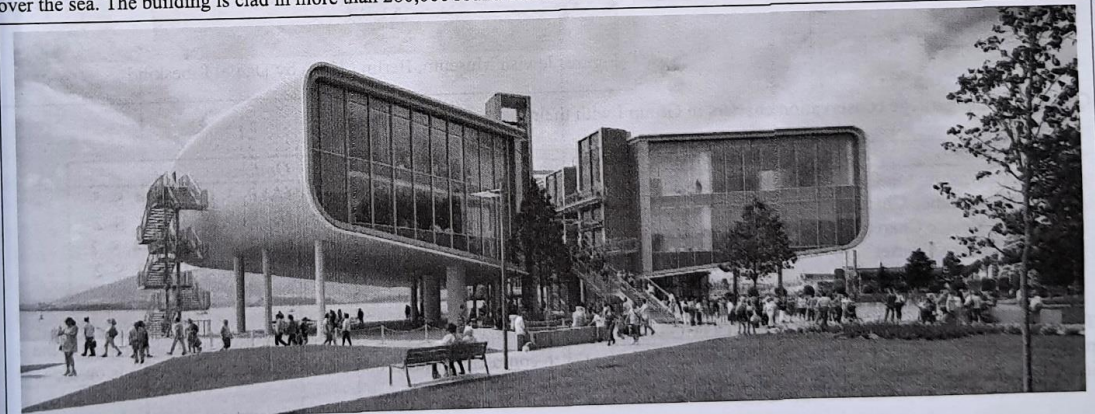


Figure: Centro Botin, Santander. Photo © Enrico Cano.

(Source: Renzo Piano Building Workshop <http://www.rpbw.com>, <https://www.royalacademy.org.uk/article/renzo-piano-8-buildings-to-know-shard>)

The use of chlorine compounds called chloramines (chlorine combined with ammonia) for disinfecting public water supplies has been increasing since the beginning of the 21st century. This disinfection method is often called chloramination. The disinfecting effect of chloramines lasts longer than that of chlorine alone, further protecting water quality throughout the distribution system. Also, chloramines further reduce taste and odour problems and produce lower levels of harmful by-products, compared with the use of chlorine alone.

**Ozone:** This gas may be used for disinfection of drinking water. However, since ozone is unstable, it cannot be stored and must be produced on-site, making the process more expensive than chlorination. Ozone has the advantage of not causing taste or odour problems; it leaves no residual in the disinfected water. The lack of an ozone residual, however, makes it difficult to monitor its continued effectiveness as water flows through the distribution system.

**Ultraviolet radiation:** It destroys pathogens, and its use as a disinfecting agent eliminates the need to handle chemicals. It leaves no residual, and it does not cause taste or odour problems. But the high cost of its application makes it a poor competitor with either chlorine or ozone as a disinfectant. (Source: <https://www.britannica.com/technology/water-supply-system/Coagulation-and-flocculation>)

Q32. Match the Temples in Group I with their style of Architecture in Group II

Group I	Group II	Options
P. Badami Cave Temples	1. Pandya style	(A) P-3, Q-1, R-2, S-5
Q. Kalugumalai Temple Complex	2. Chola style	(B) P-3, Q-4, R-2, S-1
R. Airavatesvara Temple	3. Chalukya style	(C) P-2, Q-1, R-3, S-5
S. Chennakeshava Temple	4. Vijayanagara style	(D) P-5, Q-1, R-4, S-2
	5. Hoysala style	

**Badami Cave Temples:** The city of Badami in Northern Karnataka, formerly known as Vatapi, was the capital of one of the greatest and most enduring dynasties in Southern India – the Chalukyas. There were three branches of the Chalukyas, the first of them being the 'Badami Chalukyas', who reigned from here from 543 – 753 CE.

The valley of the Mallaprabha (where Badami lies) and the Ghataprabha (both tributaries of the Krishna river) formed the very fertile heart of the farmed based economy of this early empire. Nestled in an imposing ravine that cuts through the heart of the sandstone landscape by the Mallaprabha, the site is graced by some beautiful rock-cut temples that are remnants of a bygone era.

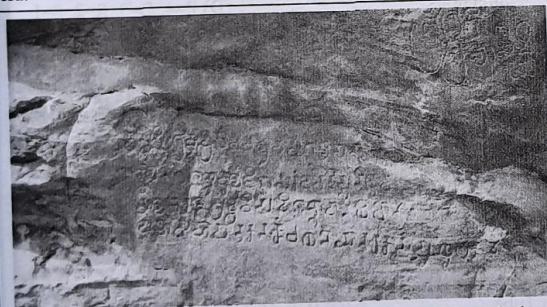


Figure: Old Kannada inscription of Chalukya King Mangalesha dated 578 CE at Badami Cave 3

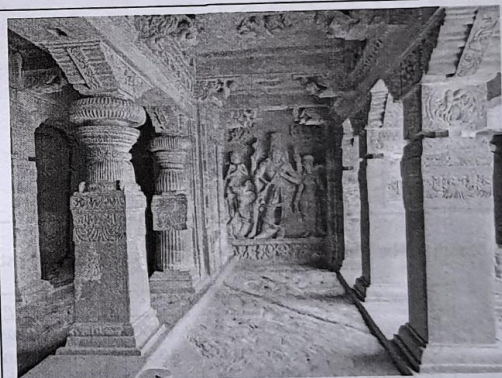


Figure: Shive sculpture and engraved pillars in cave no. 1

Q33. Match the urban form/structure in Group I with their respective proponents in Group II.

Group I	Group II	Options
P. Trabantenstadte	1. Arturo Soria Y Mata	(A) P-4, Q-1, R-5, S-3
Q. Linear city	2. Le Corbusier	(B) P-5, Q-1, R-4, S-2
R. Bloomsbury Precinct	3. Ernst May	(C) P-3, Q-1, R-5, S-2
S. Radiant city	4. Frank Lloyd Wright	(D) P-3, Q-4, R-1, S-2
	5. Patrick Abercrombie	

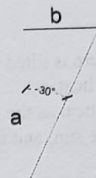
**Arturo Soria Y Mata:** The linear city design was first developed by Arturo Soria Y Mata in Madrid, Spain during the 19th century, but was promoted by the Soviet planner Nikolai Alexander Milyutin in the late 1920s. (Milyutin justified placing production enterprises and schools in the same band with Engels' statement that "education and labour will be united".) His concept first appearance was in an article in Madrid famous journal of the time, where Soria tackles the municipal policies of planning, advising a radical measure for the future planning of Madrid. The **Linear City** concept had as principal idea one strip of 500 meters wide, the long of the strip would be the necessary, by necessary we mean it could be as long as the city would require. In the center of this strip, the main actor would be the train line. Main pipes for water, gas, sewage, electricity etc. Every certain distance would be building exclusively for municipal services, like fire prevention, cleaning, sanitation, security, etc. Soria talks about the ideal form that the cities should adopt, supporting his theory in naturalistic and geometric reasoning that points out the spontaneous

(Assume that the overhang is located at the lintel level of the window)

Solution:

$$\tan 30^\circ = \frac{b}{a} = \frac{b}{1.2}$$

$$\Rightarrow b = 0.69 \text{ Answer}$$



Official GATE answer range: 0.68 to 0.70

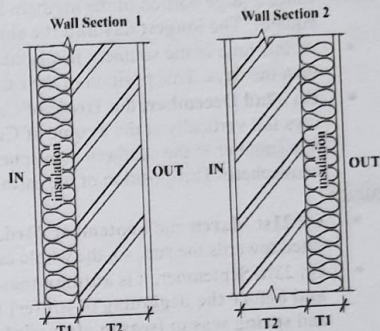
Q8. For the same thickness of material layers, relative position of insulation in the wall sections 1 and 2 shown below will have an impact on

- (A) Thermal Time Constant
- (B) Thermal Resistivity
- (C) Thermal Transmittance
- (D) Thermal Conductivity

Solution: The **Thermal Time Constant** indicates a time required for a thermistor to respond to a change in its ambient temperature. When the ambient temperature is changed from  $T_1$  to  $T_2$ , the relationship between the time elapsed during the temperature change  $t$  (sec.) and the thermistor temperature  $T$  can be expressed by the following equation. [ $\tau$  (tau in sec.) in the equation denotes the thermal time constant.]

$$T = (T_2 - T_1) (1 - \exp(-t/\tau)) + T_1$$

Please note that the above equation does not depend on the thickness of the material. But when we look at the formula of Thermal Resistivity, Thermal Transmittance & Thermal Conductivity, all depend on the thickness of the material.



So, the correct option is (A) Thermal Time Constant.

(Please also note that  $T_1$  &  $T_2$  in the question figure is different from the  $T_1$  &  $T_2$  in the answer equation.)

Q9. The solar altitude angle on April 16 at 7:00 AM in Kochi is  $16^\circ$ . The same solar altitude angle will occur at the same time in the same year at the same location on

- (A) October 21
- (B) July 21
- (C) August 27
- (D) September 23

Solution: March and September, we have Equinox. June and December we have summer and winter solstice. It means during June; the sun has direct rays on tropic of cancer in Northern hemisphere. And in the same way, during December, it will be on tropic of Capricorn in Southern hemisphere. So, if the sun starts moving slowly towards tropic of cancer from March to June. It will go via Kochi (which is northern hemisphere) in April (one month after equinox) so then after reaching June Solstice it will retreat back to Sept equinox. In this journey, it will reach Kochi one month before Sept.

So, it will reoccur in August.

Given, Kochi date was April 16. It means approx. 26 days after March 20 equinox.

So, it will be approx. 26 days before Sept 23 equinox. So, the answer should be Aug 27.

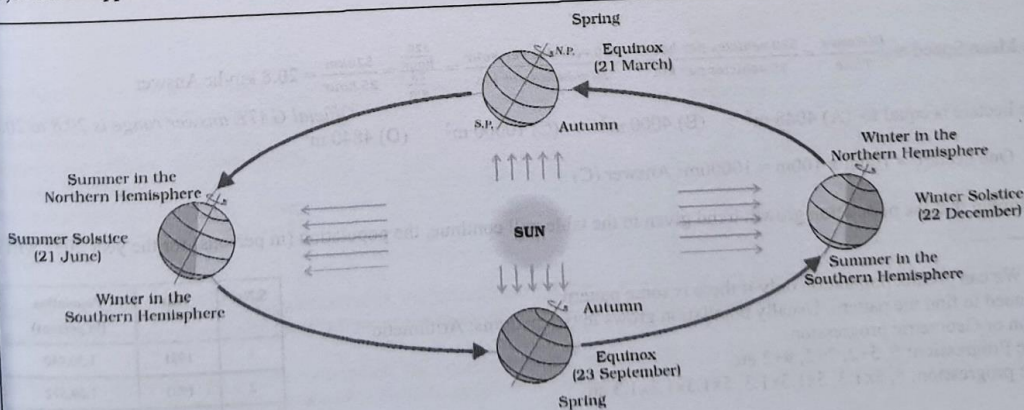
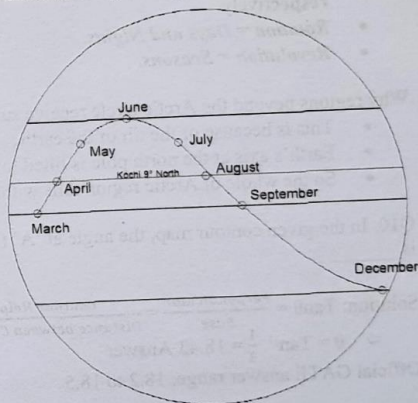
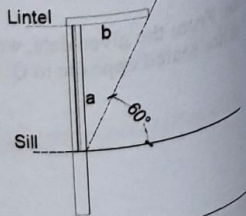


Figure: Revolution of the earth and seasons



Q61. Match the brick masonry bond type in Group with the corresponding illustration in Group II

Group I	(P) Rat Trap	(Q) English	(R) Flemish	(S) Stretcher	Options
Group II					(A) P-2, Q-5, R-1, S-3 (B) P-4, Q-1, R-2, S-5 (C) P-2, Q-1, R-4, S-5 (D) P-4, Q-1, R-2, S-3

**Brick Bonds**

**1. Stretcher Bond**

A stretcher is the longer face of the brick as seen in the elevation. In the brick of size 190 mm × 90 mm × 90 mm, 190 mm × 90 mm face is the stretcher. In stretcher bond masonry, all the bricks are arranged in stretcher courses as shown. However, care should be taken to break vertical joints. This type of construction is useful for the construction half brick thick partition wall.

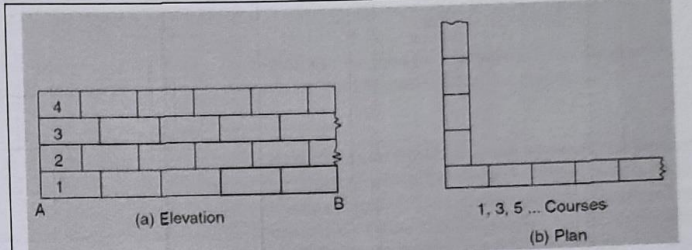


Figure: Stretcher Bond

**2. Header Bond**

A header is the shorter face of the brick as seen in the elevation. In a standard brick, it is 90 mm × 90 mm face. In header bond brick masonry, all the bricks are arranged in the header courses as shown. This type of bond is useful for the construction of one brick thick walls.

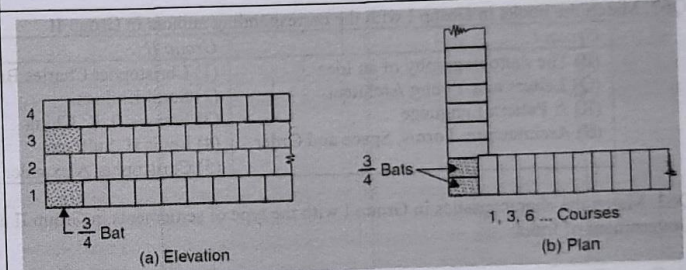


Figure: Header Bond

**3. English Bond**

In this alternate courses consist of headers and stretchers. This is considered to be the strongest bond. Hence, it is commonly used bond for the walls of all thicknesses. To break continuity of vertical joints, a brick is cut lengthwise into two halves and used in the beginning and end of a wall after first header. This is called queen closer.

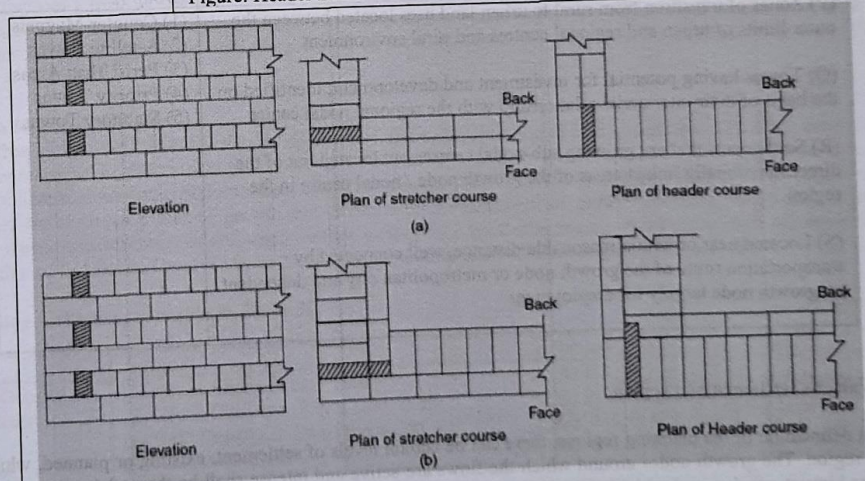


Figure: English Bond

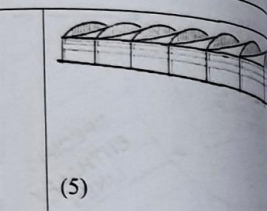
**4. Flemish Bond**

In this type of bond, each course comprises of alternate header and stretcher. Alternate courses start with stretcher and header. To break the vertical joints queen closers are required, if a course starts with header. Every header is centrally supported on the stretcher below it. Flemish bonds may be further classified as

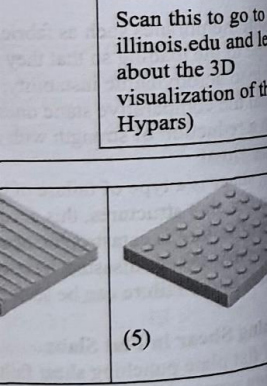
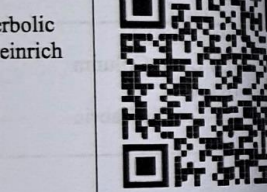
- Double Flemish Bond
- Single Flemish Bond.

In case of *double flemish bond*, both faces of the wall have flemish look, i.e. each course consist of alternate header and stretcher, whereas *single flemish bond* outer faces of walls have flemish look whereas inner faces have look of English bond.

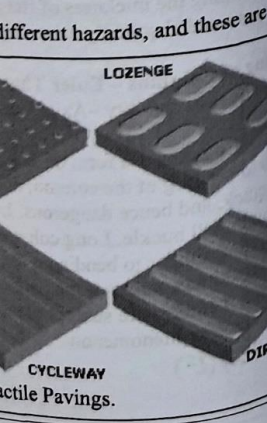
As the length increases, the same equation above the connections for the column is an Euler equation with different boundary properties. In steel columns, they bend outward, and the concrete...



1, R-5, S-2



2, R-4, S-1



Value of new construction =  $5000 \text{ m}^2 * \text{Rs. } 2500/\text{m}^2 = 125 \text{ Lakh}$   
 Depreciating rate = 6% per annum  
 Value after depreciation of construction in 5 years =  $125 (1-r)^n = 125*(1-0.06)^5 = 91.738 \text{ Lakh}$   
 Present value of property = 91.738 Lakhs **Answer**

Q.13 A residential area of 20 hectares is planned for three different types of plots of  $500 \text{ m}^2$ ,  $300 \text{ m}^2$  and  $200 \text{ m}^2$  with numbers of plot in each category are 100, 120 and 150 respectively.  
 The rest of the area is allocated for roads and facilities such as schools, shops and parks.  
 Each plot has one dwelling unit and the average household size is 5 persons.  
 The net residential density of the area in persons per hectare is \_\_\_\_\_.

Solution: Plot area = 20 Ha

Type	Area per plot (sqm)	Number	Total area (type)
A	500	100	50000
B	300	120	36000
C	200	150	30000
<b>Total</b>		<b>370</b>	<b>116000</b>

Population =  $370 \times 5 = 1850$  person  
 Net residential density = population / net area =  $1850 / 11.6 = 159.48$  pph **Answer**

Q.14 In a single lane road, traffic volume of 1000 vehicle/h moving at 20 km/h, comes to a halt due to an accident. If jam density is 150 vehicle/km, the velocity of the shock wave generated (in absolute value) is \_\_\_\_\_ km/h.

Solution: Speed of the shock-wave =  $Q_2 - Q_1 / K_2 - K_1$   
 $Q_1 = \text{Flow before Jam} = 1000 \text{ V/h}$   
 $Q_2 = \text{Flow after jam} = 0$  (because  $V = 0$ )  
 $K_1 = \text{Density before jam} = 1000 / 20 = 50 \text{ V/km}$   
 $K_2 = 150 \text{ Vehicle / Km}$  (Jam density)

Therefore, Speed of the shock-wave =  $Q_2 - Q_1 / K_2 - K_1 = 0 - 1000 / 150 - 50 = -10 \text{ km/h}$   
 So, the answer in absolute value is 10 km/h **Answer**

Q.15 In a site map, a rectangular residential plot measures  $150 \text{ mm} \times 40 \text{ mm}$ , and the width of the front road in the map measures 16 mm. Actual width of the road is 4 m. If the permissible F.A.R. is 1.2, the maximum built-up area for the residential building will be \_\_\_\_\_  $\text{m}^2$ .

Solution: As per question, 16 mm width of road = 4m = 4000 mm  
 So, 1 mm = 250 mm or scale is 1:250

Therefore, actual dimension of the plot would be,  
 Length =  $150 \text{ mm} * 250 = 375000 \text{ mm} = 37.5 \text{ m}$   
 Width =  $40 \text{ mm} * 250 = 10000 \text{ mm} = 10 \text{ m}$

So, the area of site =  $37.5 * 10 = 375 \text{ m}^2$   
 So built-up area =  $375 * \text{FAR} = 375 * 1.2 = 450 \text{ m}^2$  **Answer**

Q.16 The internal dimension of a room is  $10\text{m} \times 10\text{m} \times 4\text{m}$  (height). The total area of the doors and windows are  $16 \text{ m}^2$ . Keeping the doors and windows closed, the reverberation time of the room becomes 1.2 second. Assume all the interior surfaces including doors and windows have same sound absorption coefficient. If all the doors and windows of the room are kept fully open, the reverberation time will be \_\_\_\_\_ second (rounded off to two decimal places).

Solution: Consider the uniform absorption coefficient = a  
 Using,  $R_T = 0.16V/A$   
 $\Rightarrow 1.2 = 0.16 * 400/360a$  (Total surface area of the room is  $360 \text{ m}^2$ )  
 $\Rightarrow 360a = 400 * 0.16/1.2$   
 $\Rightarrow A = 0.148$

New  $R_T = 0.16 * 400 / (344 * 0.148 + 16 * 1) = 0.956$  **Answer**  
 Note: Out of  $360 \text{ m}^2$  of room area,  $344 \text{ m}^2$  has absorption coefficient of 0.148 and rest  $16 \text{ m}^2$  area has absorption coefficient of 1 because opened door or window has absorption coefficient of 1 as it would absorb all sound)

Q.17 A depressed portion of a land is identified by three closed contours, as shown in the figure below. The area bounded by three contour lines are  $6 \text{ m}^2$ ,  $24 \text{ m}^2$  and  $96 \text{ m}^2$  respectively. The contour interval is 1 m. Using prismoidal method, the volume of the earth needed to fill the land depression is \_\_\_\_\_  $\text{m}^3$ .

R-4, S-3  
R-4, S-5  
R-1, S-4  
R-3, S-5

Q.1 The unit for measuring sound absorption in a room is  
(A) Sabin (B) Phon (C) Decibel (3) Hertz

Solution: The correct answer is option (A) Sabin

The term "sound absorption" very common to acoustics and question is asked very frequently in GATE for calculating Reverberation time =  $0.016 \cdot (V/a)$ , where  $a$  = sound absorption coefficient in Sabin. The unit is named in honor of Wallace Clement Sabine. So, Sabin is a unit of Sound Absorption of a surface. A square metre of 100% absorbing material has a value of 1 metric sabin. An example of this would be a 1 m<sup>2</sup> open window. One square foot of 100% absorbing material has a value of 1 imperial sabin.

**Decibels, Phons, and Sones:** The rate at which sound energy reaches a given cross-sectional area is known as the sound intensity. It is common to express the sound intensity using a logarithmic scale known as the decibel scale.

Sound loudness varies from person to person. Furthermore, sounds with equal intensities but different frequencies are perceived by the same person to have unequal loudness. For instance, a 60 dB sound with a frequency of 1000 Hz sounds louder than a 60 dB sound with a frequency of 500 Hz. The unit **phon** is used to indicate an individual's perception of loudness. By definition, 1 phon is equivalent to 1 decibel at 1000 Hz (1 kHz).

The sone scale is a third scale associated with the loudness of a sound. The sone scale is based on the observation that a 10 phon increase in a sound level is most often perceived as a doubling of loudness. According to the sone scale, a 1 sone sound is defined as a sound whose loudness is equal to 40 phons.

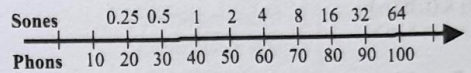


Figure: Relationship between Phon & Sone. Thumb

Q.2 A drainage basin of 180 hectares comprises 40% wooded area, 45% grassed area and 15% paved area. Runoff coefficients for wooded, grassed and paved areas are 0.01, 0.2 and 0.95 respectively. The composite runoff coefficient for the drainage basin is

Solution:  $C = [(0.01 \times 40\% \text{ of } 180) + (0.2 \times 45\% \text{ of } 180) + (0.95 \times 15\% \text{ of } 180)] / 180 = (0.72 + 16.2 + 25.65) / 180 = 0.236 = 0.24$   
Composite runoff coefficient,  $C = (A_1 \cdot C_1 + A_2 \cdot C_2 + \dots) / (A_1 + A_2 + \dots)$

Q3. He was one of my best \_\_\_\_\_ and I felt his loss \_\_\_\_\_.  
(A) friend, keenly (B) friends, keen (C) friend, keener (D) friends, keenly

Solution: In the first blank, the word 'friends' is apt. The author talks about him being one of the many, he has. In the second blank, the word 'keen', which means 'sharp, piercing, or biting' can be used to describe an emotional loss. The word 'keen' in this sentence is modifying 'felt', which is a verb. Hence it must be used in its adverbial form. Hence, 'keenly' is apt. Hence, the correct option is (D).

Q4. As the two speakers became increasingly agitated, the debate became  
(A) lukewarm (B) poetic (C) forgiving (D) heated

Solution: The word 'agitated' shows that the two speakers became disturbed and excited- leading to heated arguments. 'Heated' means to be excited or to be aroused to a high degree of passion or feeling. The rest of the options are inapt. Hence, the correct option is (D).

Q.5 Find the 'Lux' at a distance of 3 m from the light source. The light source has power of 40 Watts and Efficacy of 40 lm/W.

Answer:  $(40 \text{ Watt} \times 40 \text{ Efficacy}) / (\text{Square of } 3\text{m}) = 1600 / 9 = 178 \text{ lux}$

Solution: First find, how much lumen the light source emits. Luminous Efficacy helps out to find that. Luminous efficacy is a measure of how well a light source produces visible light. It is the ratio of luminous flux to power, measured in lumens per watt in SI.

So, Luminous efficacy = (Lumen)/(Power in Watt)

Here, 40 = Lumen/ 40

Therefore, lumen = 40 \* 40 = 1600

Now apply "Inverse square law" which says; The intensity of illumination is proportional to the inverse square of the distance from the light source.

Lux found = (lumen of light source)/(square of distance) = 1600/9 = 178 lux Answer

Q6. For a project to complete, the Optimistic time is set to 12 months, the Most likely time is set to 14 months & the Pessimistic time is 18 months. What would be the expected time for completion?

Solution: Completion time = [(Optimistic time) + 4\*(Most likely time) + (Pessimistic time)] / 6  
So,  $[12 + 4 \cdot 14 + 18] / 6 = 86 / 6 = 15 \text{ Months}$

Q7. In 2011, the population of a town was 5,00,000 and the number of housing units was 1,00,000.

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THE QUESTION PAPER 2017

Section 2: Questions on Architecture & Planning

- Q27. Autobahn is  
 (A) An automated mechanized pathway  
 (C) An intercity fast moving freeway

- (B) A totally underground high speed freeway  
 (D) A neighbourhood bicycle pathway

Autobahn is a German Highway network.  
 Other highway's known by different names in different countries:  
 Freeway – USA  
 Auto-estrada – Portugal  
 Motorway – UK  
 Autostrada- Italy  
 Autopista- Spain Answer: (C)

- Q28. The fire rating of reinforced glass doors is expressed in  
 (A) kcal (B) hour (C) watt (D) lux

It is measured in hour, for how much time the glass door can withstand the fire in emergency.

kCl (kilo Calorie) is unit of Energy.

Watt is also a unit of energy. Lux is the SI unit of illuminance, equal to one lumen per square metre. Answer: (B) HOUR

- Q29 The "Hall of Nations" in Pragati Maidan at New Delhi is essentially a three dimensional space with basic unit of  
 (A) A spheroid (B) A decahedron (C) An octahedron (D) A tetrahedron

Designed as space frame in reinforced concrete; the first of its kind in India, and perhaps in the world; the 'Hall of Nations' provides an uninterrupted exhibition area of approximately 6,700 sqm in a 82m x 82m x 27m high truncated pyramid supported on eight points. Each of the four 'Halls of Industries' is similar in design and is 44m x 44m x 16m high. Free standing coffered mezzanine floors cantilevering out of cylindrical shafts provide additional exhibition area in each hall. Answer: (C)  
 (Source: [http://www.mrc.co.in/sd\\_2.html](http://www.mrc.co.in/sd_2.html))

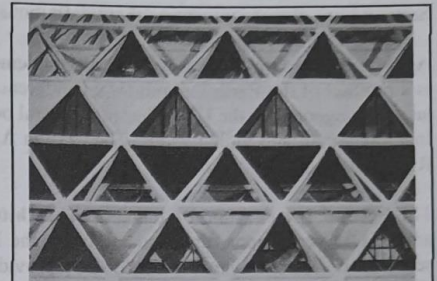
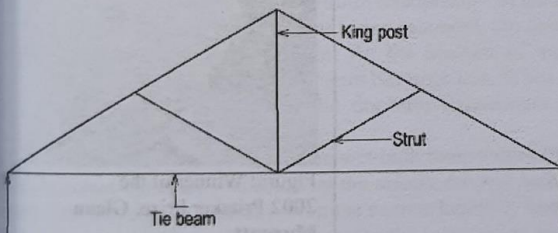
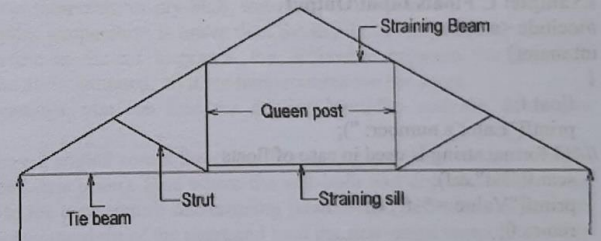


Figure: Octahedron structure of "Hall of Nations" in New Delhi

- Q30. In a pitched truss, the two vertical web members set at equal distances from the apex are called  
 (A) Joggle post (B) Queen post (C) King post (D) Jack post



King post Roof



Queen post Roof

- Q31. The international Charter guiding conservation of historic buildings and area is the  
 (A) Kyoto Protocol  
 (B) Chicago Declaration  
 (C) Agenda 21  
 (D) Venice Charter

The Kyoto protocol was the first agreement between nations to mandate country-by-country reductions in greenhouse-gas emissions. Kyoto emerged from the UN Framework Convention on Climate Change (UNFCCC), which was signed by nearly all nations at the 1992 mega-meeting popularly known as the Earth Summit. The framework pledges to stabilize greenhouse-gas concentrations "at a level that would prevent dangerous anthropogenic interference with the climate system". To put teeth into that pledge, a new treaty was needed, one with binding targets for greenhouse-gas reductions. That treaty was finalized in Kyoto, Japan, in 1997, after years of negotiations, and it went into force in 2005. Nearly all nations have now ratified the treaty, with the notable exception of the United States. Developing countries, including China and India, weren't mandated to reduce emissions, given that they'd contributed a relatively small share of the current century-plus build-up of CO<sub>2</sub>.

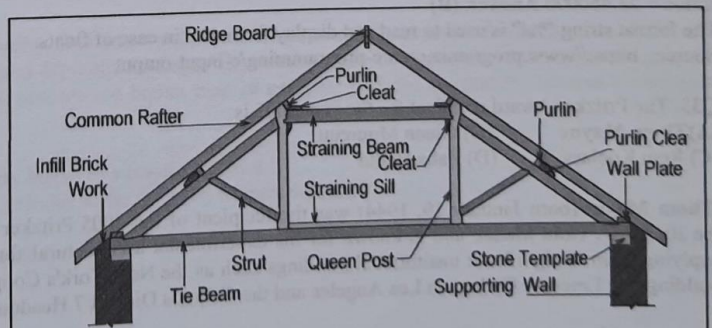


Figure: Details of the Queen post



Q70. A good thermal insulation material should possess the qualities. Select the combination of best three factors.

- P. Fir-resistance Q. Moisture resistance R. Strength  
 S. Stability T. Soundproofing  
 (A) P, Q, S (B) Q, R, S (C) P, Q, R (D) R, S, T

Q71. Match the town in Group I with their locations in Group 2

Group I	Group II	Options
P. Miletus Q. Tingad R. Monpagier S. Place Daupkine	1. Roman 2. Greek 3. French 4. English 5. German 6. Russian	(A) P-4, Q-1, R-4, S-6 (B) P-1, Q-2, R-5, S-3 (C) P-5, Q-6, R-3, S-4 (D) P-2, Q-1, R-4, S-3

Q72. Match the following paints in Group I against their most important quality as mentions in Group 2

Group I	Group II	Options
P. Cement paint Q. Plastic Emulsion paint R. Oilbound Distemper S. Synthetic Enamel paint	1. Water proofing 2. Glossy appearance 3. Decorative appearance 4. Easily washable 5. Fire resistant 6. Acid resistant	(A) P-1, Q-3, R-4, S-5 (B) P-2, Q-3, R-5, S-3 (C) P-1, Q-6, R-3, S-4 (D) P-2, Q-1, R-4, S-6

Q73. Strips of two different metals firmly joined together as shown in the figure.



Select the changed profile of the joined strips, while heated, from the figure shown below.  
 (A) P (B) Q (C) R (D) S

Q74. Match the propagator with the following concepts.

Group I (Propagators)	Group II (Concepts)	Options
P. Total architecture Q. Ekistics R. Megalopolis S. Radburn T. Conservative surgery	1. Patrick Geddes 2. Jean Gottman 3. Doxiadis 4. Walter Gropius 5. Clarence Stein	(A) P-4, Q-3, R-2, S-5, T-1 (B) P-3, Q-4, R-2, S-5, T-1 (C) P-5, Q-2, R-4, S-1, T-3 (D) P-4, Q-5, R-3, S-2, T-1

Q75. In Gandhi Smarak Saangrahalaya architect Charles Correa used different types of finishes. Select the combination of finishes used in the building.

- P. Stone cladding Q. Exposed brick R. Plastering & painting  
 S. marble chips finish T. Exposed concrete U. Plain cement concrete finish  
 (A) R, S, T (B) Q, T, U (C) P, Q, R (D) Q, R, S

Q76. Match the correct names of the architectural styles and periods.

P	Q	R	S
1	2	3	4
Moorish Style 15 <sup>th</sup> Century	Romanesque Style 11 <sup>th</sup> - 12 <sup>th</sup> Century	Gothic Style 13 <sup>th</sup> - 14 <sup>th</sup> Century	Renaissance Style 15 <sup>th</sup> - 16 <sup>th</sup> Century

- (A) P-1, Q-2, R-3, S-4 (B) P-2, Q-4, R-4, S-1 (C) P-1, Q-3, R-4, S-1 (D) P-2, Q-1, R-2, S-2

Q77. A 4 cm x 4 cm area on a map represented a land area of 16 hectares of ground. If this map is transformed to a scale of 1:5000 the same ground area will be represented by

- (A) 80 sqm (B) 32 sqm (C) 64 sqm (D) 40 sqm

2. Highlight the principles of Jain temple planning.

3. Draw the Bending Moment and Shear Force diagram for the following:

4. Critically compare between two known network analysis techniques 'PERT' and 'CPM' with respect to architectural projects.

5. Design and illustrate a general classroom for 40 students in hot-humid climate, and mention the design criteria adopted.

6. Outline the usefulness of Building Bye-laws.

7. Highlight, with suitable examples, the characteristics features of Spanish Gardens.

8. Mention the factors to be considered for thermal insulation of buildings.

9. A studio has dimensions 10m x 8m x 5m. The ceiling of studio is provided with acoustical tiles having absorption coefficient = 0.40. Curtains in heavy folds (absorption coefficient = 0.50) are provided on one short wall. The absorption power of other surfaces of the studio may be taken as 8 sq.m. sabin. What will be extra absorption units required to make reverberation time  $t = 0.75$  sec.?

Solution: Volume of the room = 10m x 8m x 5m = 400 sq.m.

$$T = 0.16 * (V/A)$$

$$\Rightarrow 0.75 = 0.16 * (400/A)$$

$$\Rightarrow 0.75 = 0.16 * (400/A)$$

$$\Rightarrow 0.75 = 0.16 * (400 / (40 * 0.5 + 80 * 0.4 + 220 * a))$$

$$\Rightarrow a = 0.15 \text{ Answer.}$$

10. What is Colour Harmony? How it differs from Colour Contrast? Give some examples.

11. Explain the function of 'BLOCK' and 'WBLOCK' commands in Autocad highlighting their attributes.

12. Draw the sketches of a 'Balanced Cantilever' and a 'Propped Cantilever' highlighting their functions.

**SECTION B (50 marks) PART II** Answer any TEN questions. All questions carry equal marks.

13. Outline the causes of soil degradations as major concern on terrestrial environment.

14. Comment on the existing mechanism of devolution of urban development fund between State and Local Government.

15. Stating the scope of 'MILE-STONE TECHNIQUE', prepare a Milestone Chart Schedule for residential site planning project.

16. Briefly discuss the system adopted for urban solid waste disposal.

17. Discuss the elements of PERT to establish its logical network in scheduling projects.

18. Evaluate the Fagence techniques of Peoples' Participation in Planning.

19. Explain through sketch a typical plan and section of Pour-Flush Waterseal Latrine.

20. Briefly outline the contents of a Development Plan.

21. (a) Illustrate to the point, the significance of Lanform in Landscape.

(b) Mention the factors which govern the decision related to Landform.

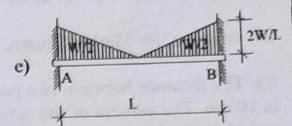
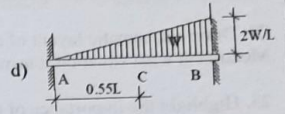
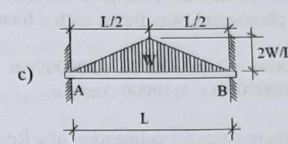
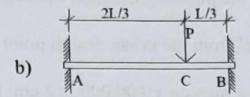
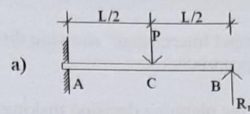
22. There are four routes from a person's home to his work place. There are two parking lots near his office building. His office building has four entrances, three elevators to reach his office floor, and one corridor from each elevator to his office door.

(a) How many ways can the person reach his office door from home?

(b) While starting from home he realizes that routes 1 and 3 are 'No Entry', Parking

23. Distinguish between the 'Spacing' and 'Headway' in a traffic stream and mention the way they can be measured.

24. Discuss the Professional Code of Conduct of a Planner to his Fellow professional.



- Outer layer of timber log is  
 (A) Heart wood (B) Strong wood (C) Sap wood (D) Knot wood
- Sun temple of Konark predominantly built with  
 (A) Basalt stone (B) Soap stone (C) Sand stone (D) Granite stone

- Average power output (in microwatt) of human speech in ordinary conversation is:  
 (A) 2.5 (B) 4.8 (C) 6.2 (D) 10.0

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

Principal determinants of a residential neighbourhood size is based on:

- (A) Landuse composition (B) **Availability of vacant land** (C) Education facility (D) Residential density

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

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.

2. Match the following:

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

2.2. Match the following:

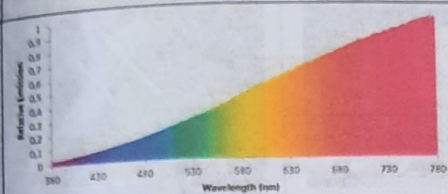
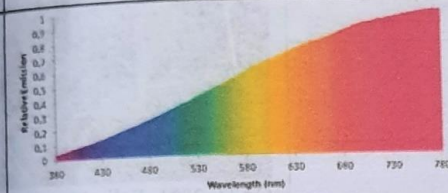
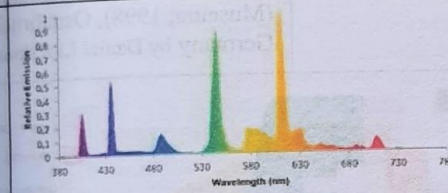
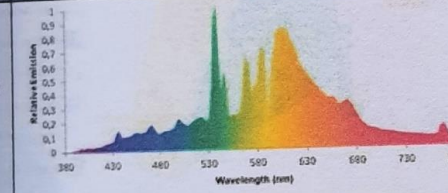
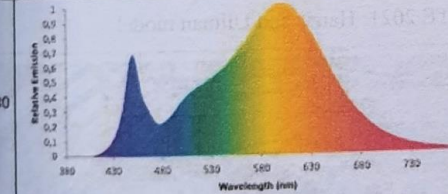
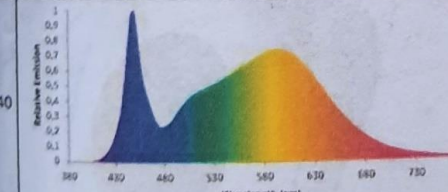
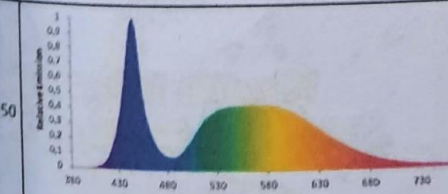
1	Crystal Palace	A	Le Corbusier (3)
2	Johnson Wax factory	B	Joseph Paxton (1)
3	Shoden Villa	C	B. V. Doshi (9)
4	German Pavillion, Barcelona	D	Mies Van der Rohe (4)
5	Pompidou Centre Paris	E	Frank Lloyd Wright (2)
6	TWA Terminal, Kennedy Airport	F	Charles Correa (7)
7	Kanchanjunga Apartment, Bombay	G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

3. Match the following:

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

3. Match the following:

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

Description	Spectrum	Lamp or module luminous flux, measured (lm)	System luminous efficacy (lm/W)	Energy conversion efficiency	Theoretical maximum luminous efficacy (lm/W)
High voltage neon, 120 W		2249	17.7	11.9	148.7
Low voltage neon, 60 W		1535	25.6	15.4	166.3
Fluorescent lamp T 5, 54 W, 830		4184	81.6	23.7	344.4
Metal halide lamp, 70 W, 830		7912	99.2	31.5	314.5
LED, 35 W, 830		4739	138.6	42.3	327.6
LED, 35 W, 840		4806	139.3	43.7	318.8
LED, 16 W, 750		2436	150.5	48.7	309

GATE 2021: The table shows observed and the theoretical maximum luminous efficacy of different spectra. From the table we can see that the typical spectrum of a warm white LED achieves a theoretical module luminous efficacy of approx. 320 lm/W. However, since the assumption is that there is loss-free conversion of physical radiated power into the wavelengths of the spectrum, then the actual realisable module luminous efficacy is much smaller. In future, it may be possible to achieve system luminous efficacy in the range of 200 – 250 lm/W.



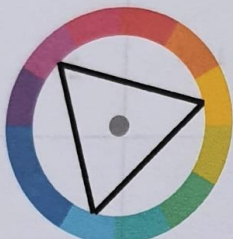
GATE 2021: Museum of Military History (2011), Dresden, Germany by Daniel Libeskind



GATE 2021: Felix Nussbaum House (Museum, 1998), Osnabruck, Germany by Daniel Libeskind



Red Green Blue  
Triad Color Harmony



Cyan Magenta Yellow  
Triad Color Harmony

GATE 2021: Three colors that are evenly spaced on the Color Wheel form a Triad or Triadic Color Harmony. Two fundamental triad color combinations on an RGB Color Wheel are the Red, Green, and Blue (RGB) primaries and the Cyan, Magenta and Yellow (CMY) set used in printing.  
(Source: <https://medium.com/nightingale/three-way-color-in-a-donut-visualization-b22aad7b9617>)



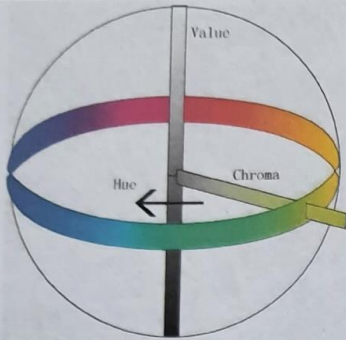
GATE 2021: Harris and Ullman model



**Khalifa International Stadium**

GATE 2021: Imaginary by Cartosat -3 of an urban area in Doha. Cartosat-3 is a third-generation agile advanced earth observation satellite with high-resolution imaging capability. Developed by the ISRO, it will replace the IRS series. Cartosat-3 has a panchromatic resolution of 0.25 metres making it the imaging satellite with highest resolution and Mx of 1 metre with a high-quality resolution, which is a major improvement from the previous payloads in the Cartosat series.

Figure 2020: Bakula  
be very sacred in Jain  
Mimusops elengi is one  
majority of the world  
fruit, seed, bark and fl  
present investigation o



GATE 2020: Structure of the Munsell color system in space. The 3-D Munsell Color System.



GATE 2020: Buckling of Concrete Columns.

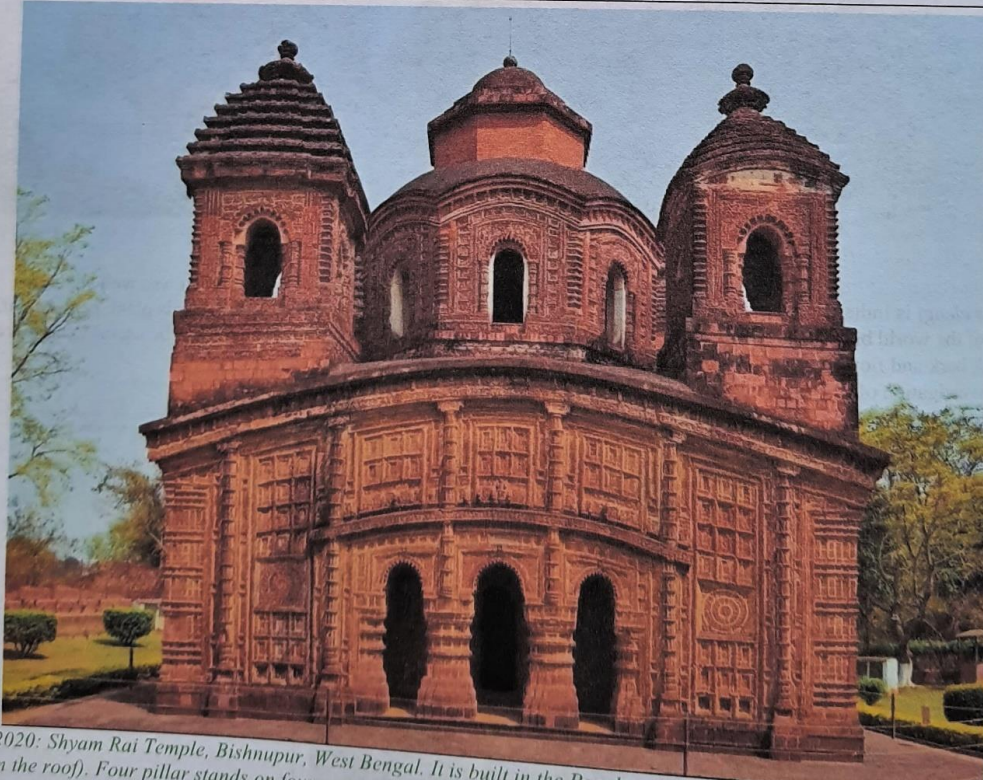


GATE 2020: A Representation of the Munsell Color Solid Cylindrical Coordinates. sRGB approximations of the 1943 Munsell color notations.

Because each color has three dimensions, an arrangement of all colors takes a three-dimensional form. The gray scale serves as the center pole, with white at the top and black at the bottom. The Munsell color solid cannot take the shape of a perfect sphere because hue families contain different numbers of steps in chroma.



GATE 2020: Flat Slab Failure due to Punching shear.



GATE 2020: Shyam Rai Temple, Bishnupur, West Bengal. It is built in the Panchratna Architectural style (in which five pillars stand on the roof). Four pillar stands on four corners and one at the centre. The word Panchratna means Panch = five & Ratna = Gems.



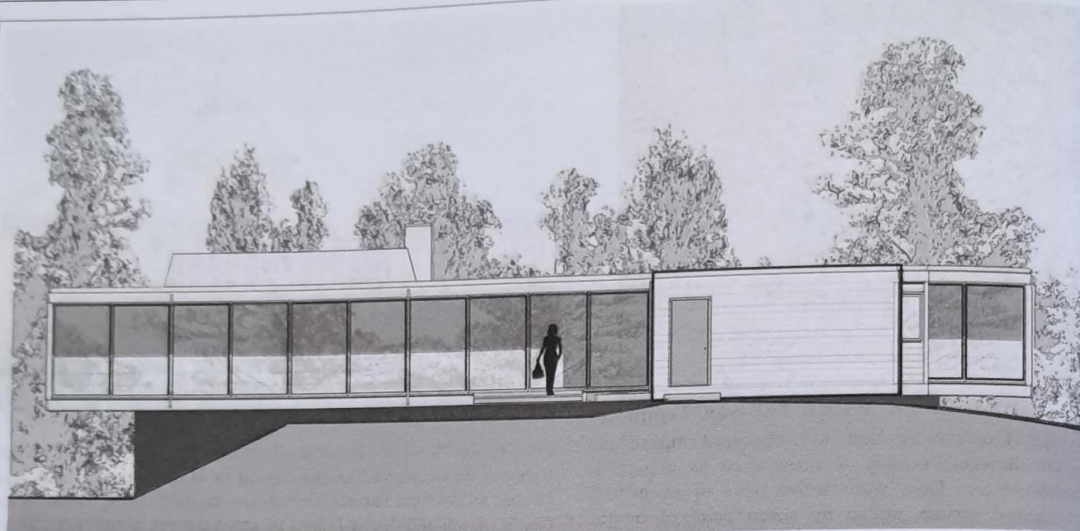
GATE 2020: Central Park, New York



GATE 2020: The Katsura Imperial Palace. The palace is a masterpiece of Japanese architecture. The palace is a masterpiece of Japanese architecture. The palace is a masterpiece of Japanese architecture.



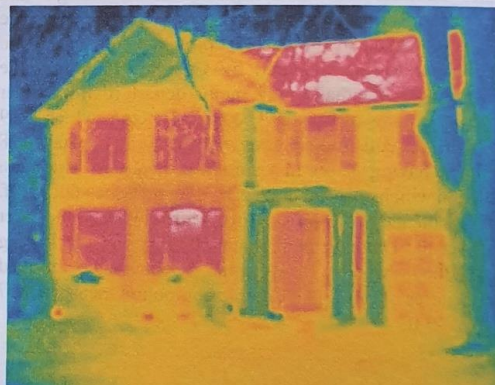
GATE 2020: Example of post tensioning. Image shows a tendon in a concrete slab.



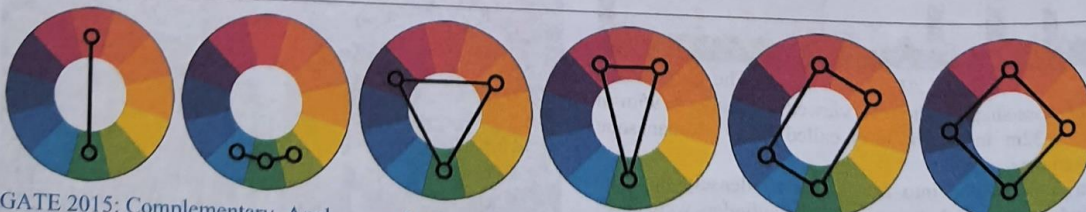
**Figure: German Pavilion for World Exhibition, Barcelona.** Designed by **Mies van der Rohe** was the flag that was presented Germany to the International Exhibition held in Barcelona 1929 and represented the introduction to the world of the modern architectural movement. It was conceived to accommodate the official reception presided over by King Alfonso XIII with the German authorities. Originally called the German Pavilion, later renamed Barcelona Pavilion was the card of Germany after WWI, emulating the progress within the modern culture of a nation that still had its roots in the classic story. Its sleek design combined with rich natural materials Mies served as a bridge to their future career within the architectural modernism.



**Figure: Hagia Sophia.** It is a great architectural beauty and an important monument both for Byzantine and for Ottoman Empires. Once a church, later a mosque, then a museum and now a mosque at the Turkish Republic, Hagia Sophia has always been the precious of its time. The Hagia Sophia, whose name means "holy wisdom," is a domed monument originally built as a cathedral in Constantinople (now Istanbul, Turkey) in the sixth century A.D.



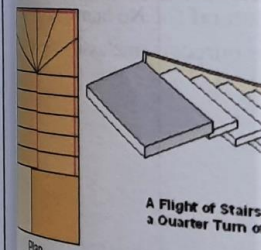
**GATE 2015: Infrared mapping.** Most household heat is lost through the windows and roof as shown in the figure.



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

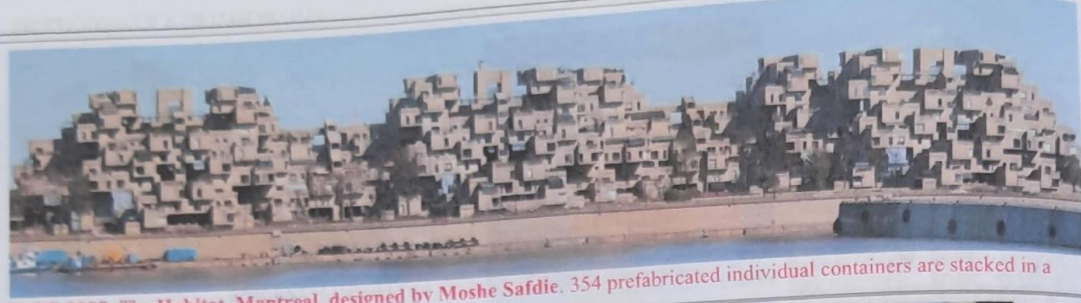


**GATE 2015: Crystal Palace, I**  
prefabricated parts. It consisted  
the building was 1,848 feet (563 m  
aces). The construction occupied  
at 92,000 square metres, or abo  
of display tables.



**GATE 2014: Example of Win**





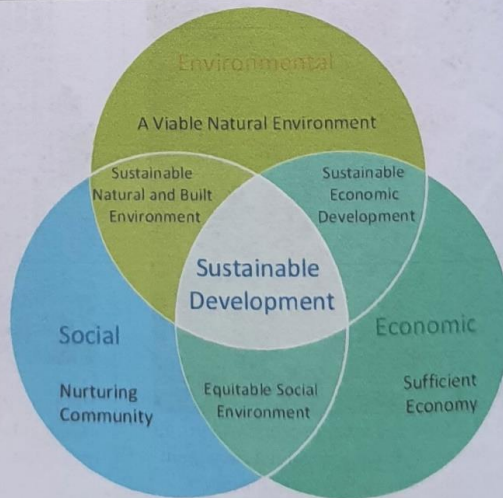
GATE 2007: The Habitat, Montreal, designed by Moshe Safdie. 354 prefabricated individual containers are stacked in a



GATE 2007: The Rietveld Schröder House in Utrecht was commissioned by Ms Truus Schröder-Schräder, designed by the architect Gerrit Thomas Rietveld, and built in 1924. This small family house, with its interior, the flexible spatial arrangement, and the visual and formal qualities, was a manifesto of the ideals of the De Stijl group of artists and architects in the Netherlands in the 1920s, and has since been considered one of the icons of the Modern Movement in architecture.



GATE 2006: The De Rotterdam complex, located in the Dutch city of the same name, was devised as a vertical city and is composed of three towers that house apartments, offices, shops, restaurants, and a hotel. At nearly 500 feet tall and with 1.7 million square feet of floor space across the towers, the building is the largest in the country. Designed by Rem Koolhaas



GATE 2009: Sustainable development is "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

GATE 2007: Villa Tugendhat's design principle of "less is more" architecture, a groundbreaking approach that enabled him to dispense with su



GATE 2006: Koolhaas reinvented the office building as a vertical city, the headquarters for CCTV. The building is connected by a 246-foot cantilevered overhang. The exterior is a striking pattern of triangles, and the support structure is a series of columns.

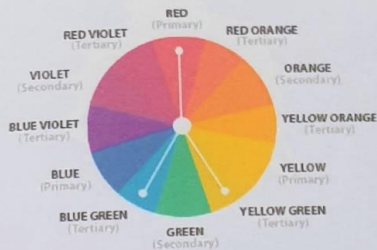


Herringbone



GATE 2007: Cohort is a group of people who share a common characteristic, such as age or education on the basis of



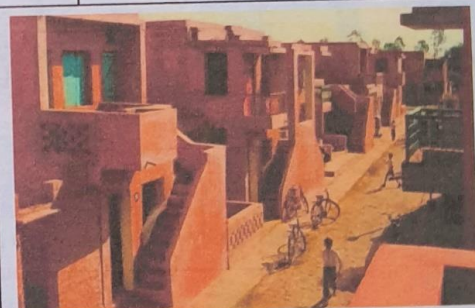


GATE 2002:

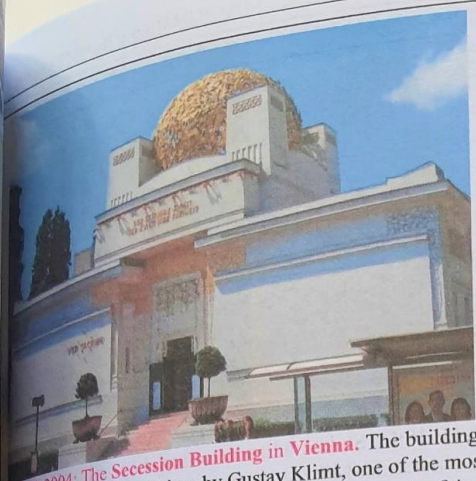
The **split-complementary color scheme** is a variation of the **complementary color scheme**. In addition to the base color, it uses the two colors adjacent to its complement.



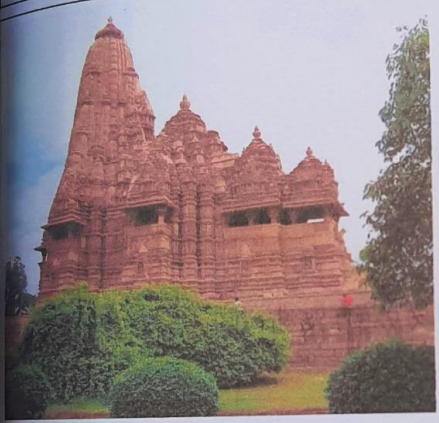
GTAE 1999: After Image: If the viewer stares at this image for 20–60 seconds and then looks at a white object, a negative afterimage will appear (in this case the original colour of American flag).



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



GATE 2004: The **Secession Building in Vienna**. The building features the Beethoven Frieze by Gustav Klimt, one of the most widely recognized artworks of Secession style (a branch of Art



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 2004: The **Ian Potter centre in Australia** designed by **Lab Architecture studio**. The Ian Potter Centre: NGV Australia is the first gallery dedicated entirely to the finest works of both indigenous and non-indigenous Australian artists from all periods, featuring the most comprehensive display of Australian art in all media. The three-level 13,000 sqm gallery represents a declaration of the 'coming of age' of Australian art. As the national repository of Australian art, the Centre has been designed to the highest standards. The Centre acknowledges the importance of contemporary art and how it reflects the society of the day by dedicating more than 3,000sqm of exhibition space to modern and contemporary art.



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Doha Skyline  
Image Tracing by J Rahul

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