QUESTION BANK

2020 ~ 2017

PART1

Printed in colour for better recall in exam

By Faculty of Architecture

GATE ARCHITECTURE

gatearchitecture.com

~ Review of the Question Paper of GATE in Architecture & Planning with Essential Notes ~

(2020 ~ 2017)

By

Faculty of Architecture

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Preface

Complete Syllabus through Question Bank: The best way to prepare for an exam like GATE is through comprehensive study of previous year question papers. It takes less time to cover most part of the syllabus. Solving the previous 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 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 form 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 in news that a teacher Ranjitsinh Disale got shortlisted for $1mn Global Teacher Prize 2020 for using QR-codes based book for teaching in school.

This book is very concise. It contains very exhaustive source of reference material for 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!

Scan to know more about Ranjitsinh Disale shortlisted for Global Teacher Prize 2020

All Pages Color Printed: All pages and illustrations of this Question Bank are color printed. Paper published by National Center for Biotechnology Information, US suggests that there are positive effects of color illustration on cognitive process.

Complete Package: This question bank contains question papers of last 30 years from 2020 to 1991. 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.

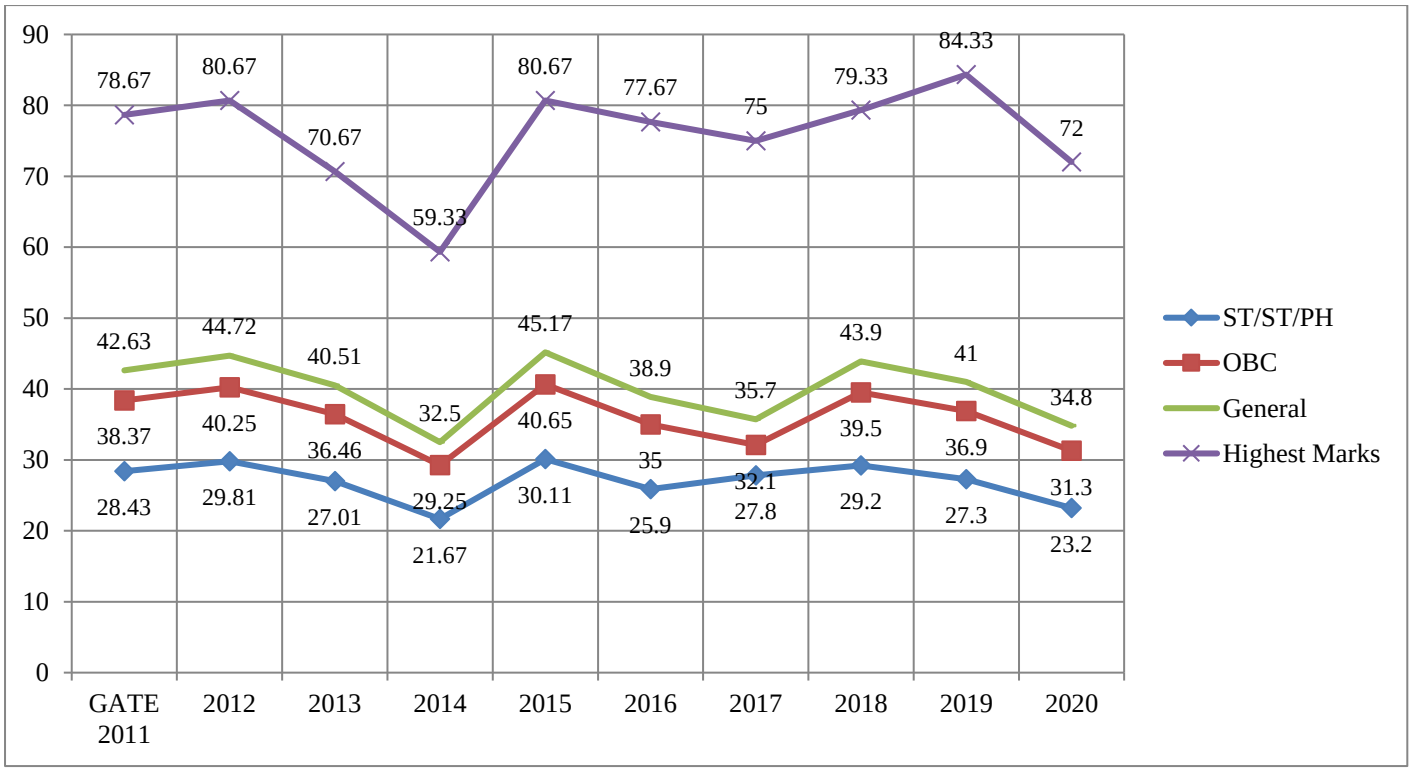
Feedback: We keep improving the contents of this book through the feedback and suggestion from the readers. You are always welcome for your valuable suggestion and feedback about this book. If you find better contents or alternative solution, send us to gatearchitecture@gmail.com

We request you to write a fair review on the ecommerce webpage from where you have bought the book.

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

Happy reading. Make most of this book. We wish you all the best for GATE 2021.

GATE AR Cut-off marks & Highest mark trend



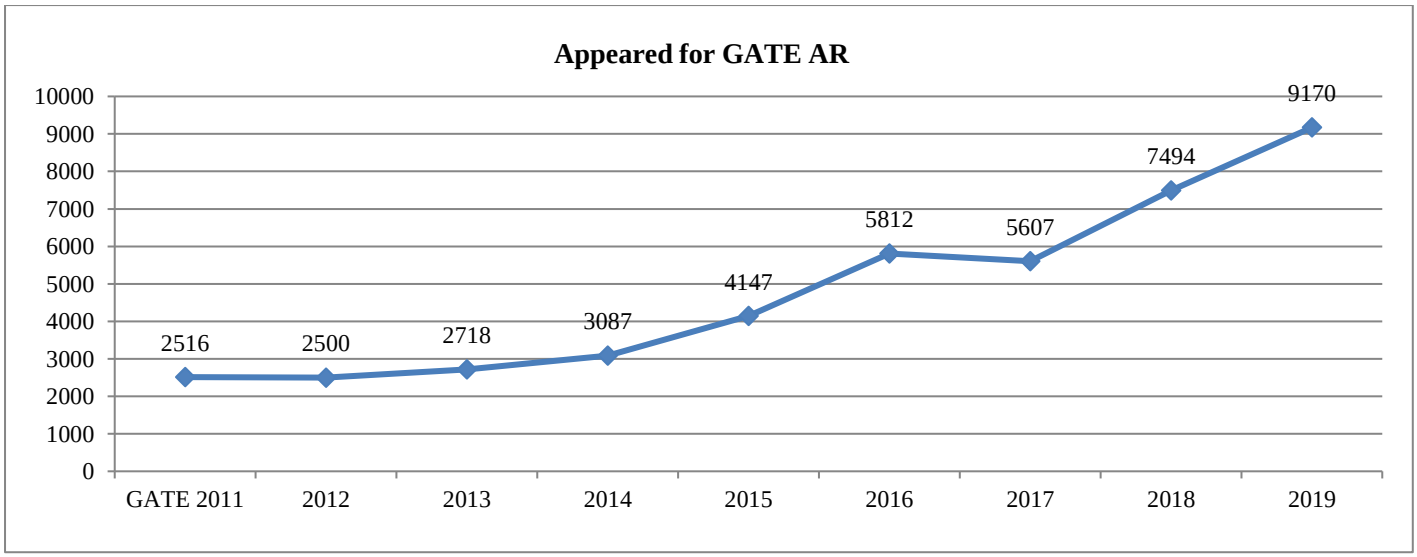


Table of Contents

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

Syllabus 2020

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, Land use 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.

Section 9: General Aptitude

GATE 2020

Numerical Questions:

Q1. The difference between the sum of the first *2n* natural numbers and the sum of the first *n* odd natural numbers is

(A) $2n^2 + n = 36$ (B) $n^2 - n = 12$ (C) $2n^2 - n = 28$ (D) $n^2 + n = 20$

Solution: Sum of the first 2n natural numbers is:

$1 + 2 + 3 + \ldots\ldots\ldots + 2^n = \frac{2(n)(2n+1)}{2} = 2n^2 + n$

Sum of the first n odd natural numbers is:

$1 + 3 + 5 + \ldots\ldots\ldots + 2(n-1) = n^2$

So, required difference = $2n^2 + n - n^2 = n^2 + n$ Answer. So, correct option is (D)

For student of architecture, the above formulae may not help as not frequently used.
We will solve the above question by taking an example.
Let, n = 4

So, first 2n natural numbers = first 2*4 natural numbers = first 8 natural numbers
= 1, 2, 3, 4, 5, 6, 7, 8
So, Sum of first 2n natural numbers = 1+2+3+4+5+6+7+8 = 36

First n odd natural number = First 4 odd natural numbers (because n =4) = 1, 3, 5,7
So, sum of first n odd natural numbers = 1+3+5+7 = 16

Therefore, the difference between = 36 – 16 = 20 ……(e)
Now, we will check which of the given four options gives answer 20 when n = 4.
(A) $2n^2 + n = 36$ (B) $n^2 - n = 12$ (C) $2n^2 - n = 28$ (D) $n^2 + n = 20$
So, as per equation (e), the correct option is (D) $n^2 + n$ Answer

Q2. The profit shares of two companies P and Q are shown in the figure. If the two companies have invested a fixed and equal amount every year, then the ratio of the total revenue of company P to the total revenue of company Q, during 2013 - 2018 is _____.

(A)16: 17 (B)17: 16
(C) 17: 15 (D)15 : 17

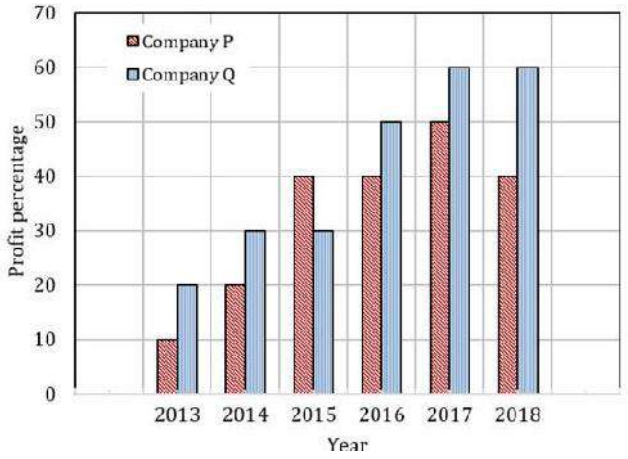


Figure: For question number 2

Solution: Suppose Rs. X is invested every year by Company P and Company Q.

The total revenue by P from 2013 – 2018 is:

$\frac{x}{100} * [110 + 120 + 140 + 140 + 150 + 140] = 8x$

The total revenue by Q company from 2013 – 2018 is:

$\frac{x}{100} * [120 + 130 + 130 + 150 + 160 + 160] = \frac{17x}{2}$

So, Required ratio is $8x : \frac{17x}{2} = 16:17$ Answer

Q3. P. Q, R, S, T, U. V. and Ware seated around a circular table.
I. S is seated opposite to W.
II. U is seated at the second place to the right of R.
III. Tis seated at the third place to the left of R.
IV. V is a neighbour of S.

Which of the following must be true?
(A) Q is a neighbour of R.
(B) P is not seated opposite to Q.
(C) R is the left neighbour of S.
(D) P is a neighbour of R.

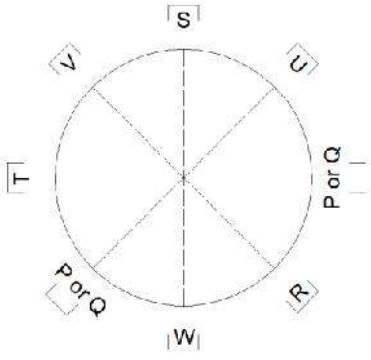
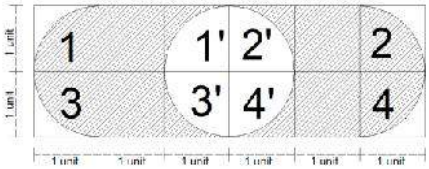


Figure: Answer to question number 3

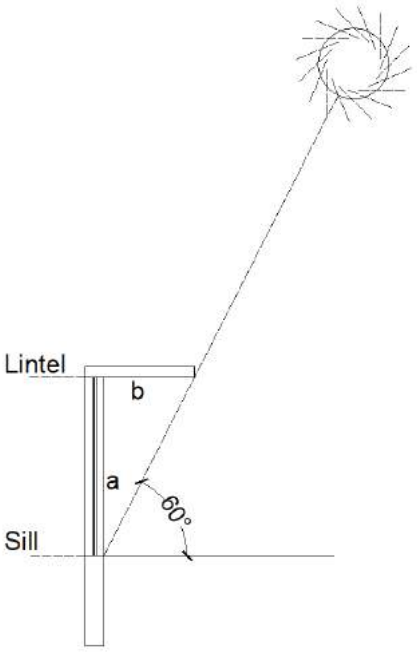
Solution: From the given data, we have following diagram:
So, P is not seated opposite to Q.

Solution:

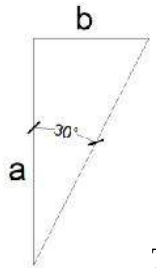


Here, Area of region 1 = Area of void region 1' and so on.
Therefore, area of the shaded portion = 8 units Answer.

Q7. A 1.2 m high window is located on a south facing wall. The solar azimuth angle is equal to the wall azimuth angle and the solar altitude angle is 60°. The minimum depth (in metres, *rounded off to two decimal places)* of overhang required to completely shade the window is _____.
(Assume that the overhang is located at the lintel level of the window)



Solution:



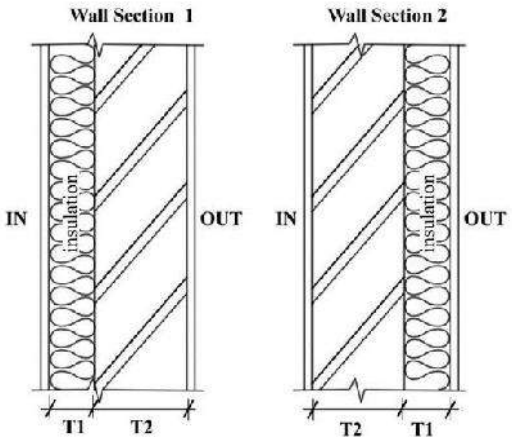
$\text{Tan } 30° = \frac{b}{a} = \frac{b}{1.2}$

⇨ b = 0.69 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 l 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 T1 to T2, the relationship between the time elapsed during the temperature change *t* (sec.) and the thermistor temperature T can be expressed by the following equation. [τ (tau in sec.) in the equation denotes the thermal time constant.]

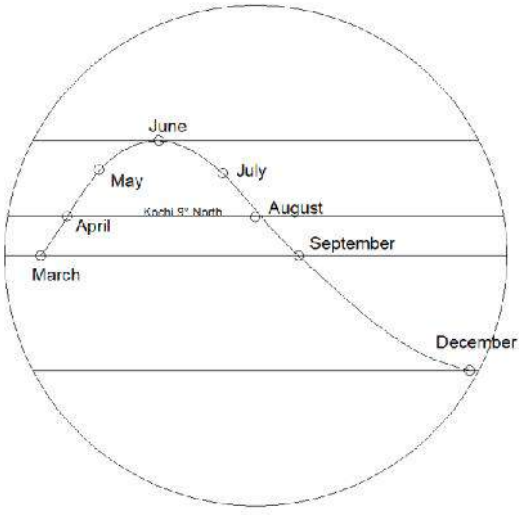
$$T = (T_2-T_1)\left(1-\exp(-t/\tau)\right) + T_1$$

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 T1 & T2 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°. 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 Dec 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) on 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 on August.
Given, Kochi date was April 16. It means approx. 26days after March 20 equinox.
So it will be approx. 26 days before Sept 23 equinox. So, the answer should be Aug 27.

More about Solstice & Equinox:

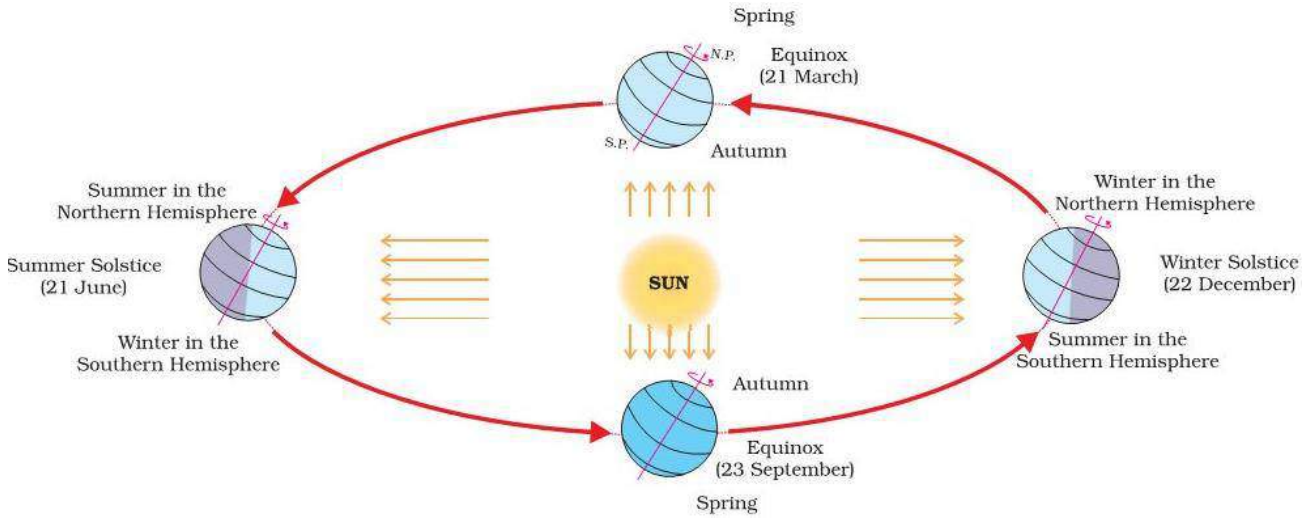


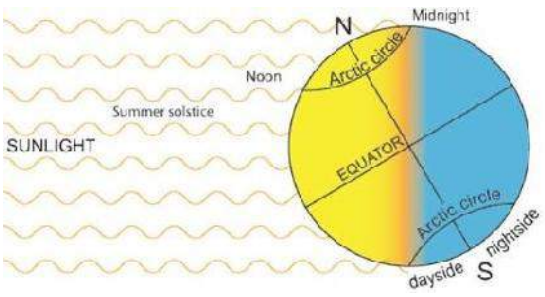
Figure: Revolution of the earth and seasons

Solstice

- On **21st June**, the northern hemisphere is tilted towards the sun. The rays of the sun fall directly on the **Tropic of Cancer**. As a result, these areas receive more heat.
- The areas near the poles receive less heat as the rays of the sun are slanting.
- The north pole is inclined towards the sun and the places beyond the **Arctic Circle** experience continuous daylight for about six months.
- Since a large portion of the northern hemisphere is getting light from the sun, it is summer in the regions north of the equator. The **longest day and the shortest night** at these places occur on **21st June**.
- At this time in the southern hemisphere all these conditions are reversed. It is winter season there. The nights are longer than the days. This position of the earth is called the **summer solstice.**
- On **22nd December**, the Tropic of Capricorn receives direct rays of the sun as the south pole tilts towards it. As the sun's rays fall vertically at the **Tropic of Capricorn** (23½° s), a larger portion of the southern hemisphere gets light. Therefore, it is summer in the southern hemisphere with longer days and shorter nights. The reverse happens in the northern hemisphere. This position of the earth is called the **winter solstice.**

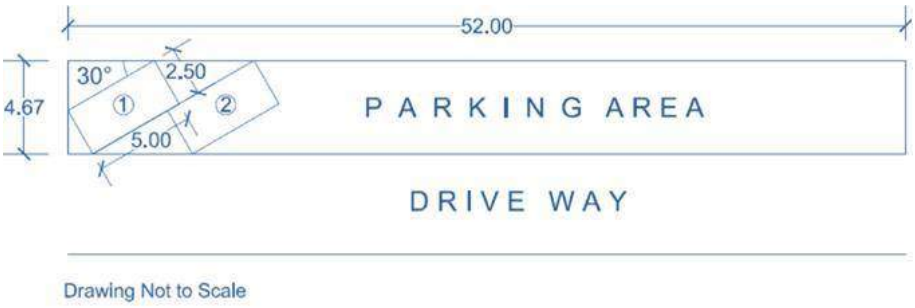
Equinox

- On **21st March** and **September 23rd**, direct rays of the sun fall on the equator. At this position, neither of the poles is tilted towards the sun; so, the whole earth experiences equal days and equal nights. This is called an equinox.
- On 23rd September, it is **autumn season [season after summer and before the beginning of winter]** in the northern hemisphere and **spring season [season after winter and before the beginning of summer]** in the southern hemisphere. The opposite is the case on 21st March, when it is spring in the northern hemisphere and autumn in the southern hemisphere.
- Thus, you find that there are **days and nights and changes in the seasons because of the rotation and revolution of the earth respectively**.
- ***Rotation = Days and Nights.***
- ***Revolution = Seasons.***



Why regions beyond the Arctic circle receive sunlight all day long in summer?

- This is because of the tilt of the earth.
- Earth's axis at the north pole is tilted towards the sun in summer.
- So the whole of Arctic region falls within the 'zone of illumination' all day long in summer.



The number of cars that can be parked in the designated parking area considering no car overshoots the length of the parking area is _____.

Solution: L = 0.58+5N
52 = 0.58 + 5N
5N = 51.42
N = 10.28 = 10 cars Answer

Thumb rule for car space of 2.5m*5m:
30◦ parking: , L = 0.58+5N
45◦ parking: L= 3.54 N+1.77
60◦ parking: L = 2.89N+2.16

Scan for more about street car parking.

Q16. A developer would like to select a residential plot of 3000 m^2 for group housing in a city. Different options with varying development controls are given. In every group housing plot, 15% of the Floor Area Ratio (FAR) over and above the maximum permissible FAR has to be utilized for Economically Weaker Section (EWS) units.
The maximum built-up area (in m^2) available from the options given below is _____.

Area	Ground Coverage (%)	FAR
1	30	1.5
2	20	2.0
3	40	2.0
4	15	3.0

Solution: Here there is nothing to do with the Ground Coverage (%). That might be given to drive out your attention.
The maximum built-up area available = 1.15 x 3 x 3000 m^2 = 10350 Answer

Q17. Number of married couples in a household along with number of rooms (for a household) are given in the table. Assuming each married couple needs one separate room, the total number of **additional rooms** required for them is _ .

Number of Married couples in a household	Number of households with		
	1 Room	2 Room	3 Room
0	2500	450	100
1	4700	3000	2000
2	3600	5500	1100
3	432	750	400

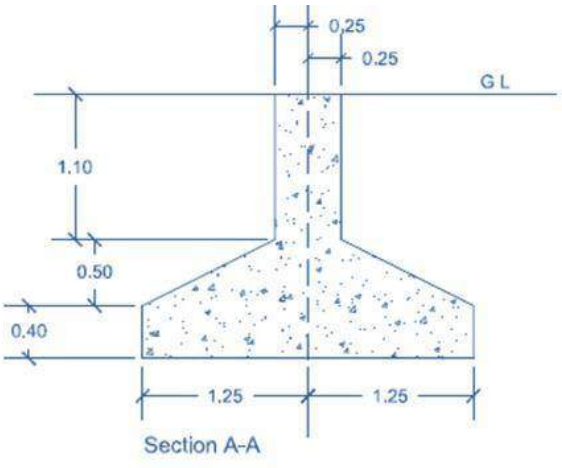
Solution: For two married couple household, the household with 1 Room which is 3600 in number should have addition **one more room** to make it habitable by the two married couple in a household. Here, additional room required = 3600 x 1 = 3600

Similarly, for three married couple household, the household with 1 Room which is 432 in number should have additional **two more rooms** to make it habitable by the three married couple in a household. Here, additional room required = 432 x 2 = 864

Similarly, for three married couple household, the household with 2 Room which is 450 in number should have additional **one more room** to make it habitable by the three married couple in a household. Here, additional room required = 750 x 1 = 750

So, total required room = 3600 + 864 + 750 = 5214 Answer

Q18. Plan and section of an isolated foundation is given below. The volume of concrete up to Ground Level (GL) (in m^3, *rounded off to two decimal places)* is _____.

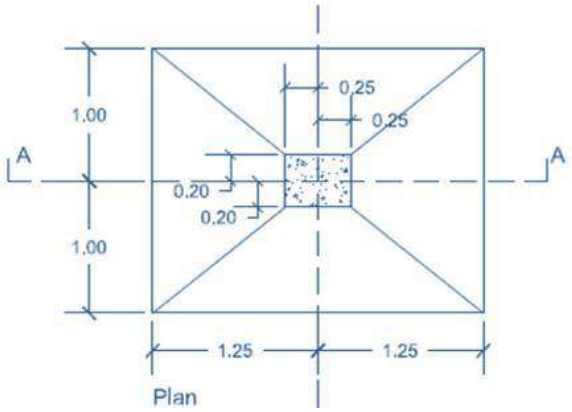


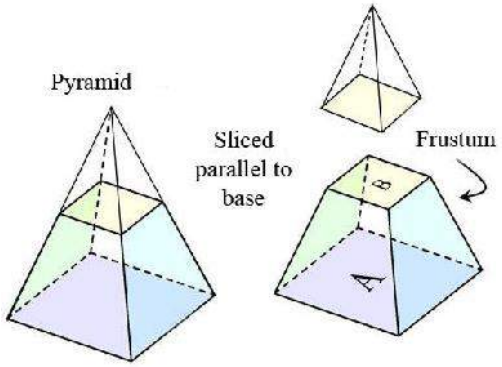
Solution: Let's divide the foundation in 3 parts.
Part I: Rectangular base with height 0.4m
Part II: Slant base with height 0.5m
Part III: Column part with height 1.1m

Part I, Volume = Base area * 0.4m = (2m x 2.5m) * 0.4 = $2m^3$
Part II, Volume = Average base area * 0.5m = $\frac{(2m \times 2.5m)+(0.4m \times 0.5m)}{2}$ * 0.5m = $2.51m^2$*0.5m = 1.23 m^3
Part III, Volume = Column cross sectional area * 1.1m = (0.4m x 0.5m) * 1.1m = 0.22 m^3

Total volume = 2 + 1.23 + 0.22 = $3.43m^3$

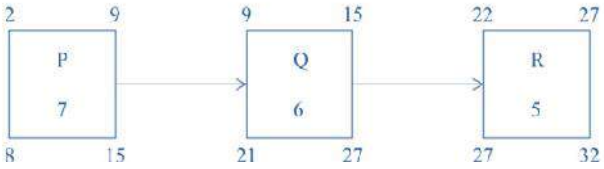
Please note that volume of the Part II is not accurate (Average area used for faster calculation). It is actually a frustum.





Volume of Frustum = 1/3* h*(A + B + $\sqrt{AB}$) = 1/3*0.5*(5 + 0.2 + $\sqrt{5x0.2}$) = 1/3*0.5*6.2 = 1.03 m^3
Official GATE answer range is 3.1 to 3.4

Q19. The activity duration, early start, early finish, late start and late finish of the three activities 'P', 'Q' and 'R' are shown in the following figure. The **independent float** of activity 'Q' is



Solution: Independent Float
= ES of succeeding activity – LF of preciding - Duration of the activity of which Independent float is to be counted
= ES of R – LF of P – Duration of Activity Q
= 22 – 15 – 6
= 1 Answer

Scan for pdf on Total, Free, Independent & Interfering float.

Scan for video lecture on Total float & Free float.

Scan for video lecture on Independent float

Figure: Scan for explanation on YouTube for Independent Float

Q20. A population of 2500 persons requires a minimum area of 3000 m^2 for primary schools. For the population in four different sectors given in the table below, the **Sector** having maximum shortage of school area per person is _____.

Q31. Repo rate is the rate at which Reserve Bank of India (RBI) lends commercial banks, and reverse repo rate is the rate at which RBI borrows money from commercial banks.
Which of the following statements can be inferred from the above passage?
(A) Increase in repo rate will decrease cost of borrowing and decrease lending by commercial banks.
(B) Decrease in repo rate will decrease cost of borrowing and increase lending by commercial banks.
(C) Decrease in repo rate will increase cost of borrowing and decrease lending by commercial banks.
(D)Increase in repo rate will decrease cost of borrowing and increase lending by commercial banks.

Q32. Shyam-Rai temple of Bishnupur in West Bengal, is an example of
(A) Pancha-ratna type terracotta temple (B) Stone carved Dravidian type temple
(C) Nava-ratna type terracotta temple (D) Stone carved Nagara type temple

Notes: Made of bricks, with square-shaped towers at the corners, the Shyam Rai Temple is massive in terms of its scale and embellishments. It was built by king Raghunatha Singh (1702-1712) of Mallabhum, in 1643, to honour Lord Vishnu in his form as Lord Krishna. It is built in the Panchratna Architectural style (in which five pillars stand on the roof) and is probably the state's oldest temple reflecting this design. One can also catch a few glimpses of the Gandhar style (Buddhist art) on the walls. The artists have displayed remarkable skill and craftsmanship in intricately engraving designs on the baked bricks to make the temple. The four sides of the temple are followed by arched gateways leading to the sanctum. The temple has figurines and floral motifs, which were the first of its kind in the state. The inner and outer walls, along with the ceiling, are adorned with terracotta sculptures depicting Krishna leela and episodes from great Indian epics like Ramayana and Mahabharata. Answer (A)

Figure: 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 an four corners and one at the centre. The word Panchratna means Panch = five & Ratna = Gems.

GATE 2019

Section 1: Numerical Questions

Q.1 The radius as well as the height of a circular cone increases by 10%. The percentage increase in its volume is ____.
(A) 17.1 (B) 21.0 (C) 33.1 (D) 72.8

Solution: We know for volume of a (right circular) cone is $\frac{1}{3}\pi r^2 h$
Original volume (V_o)
$(V_o) = \frac{1}{3}\pi r_1^2 h_1$
Now we know radius and height both are increased by 10%. So, after increase, the new volume will be:
$(V_n) = \frac{1}{3}\pi(1.1r_1)^2(1.1)h_1 = 1.331*(\frac{1}{3}\pi r_1^2 h_1) = 1.331 *(V_o)$
% change in volume = $\frac{Vn-Vo}{Vo}$ x 100% = $\frac{1.331Vo-Vo}{Vo}$ x 100% = 33.1% Answer

Q.2 Five numbers 10, 7, 5, 4 and 2 are to be arranged in a sequence from left to right following the directions given below:
1. No two odd or even numbers are next to each other.
2.The second number from the left is exactly half of the left-most number.
3.The middle number is exactly twice the right-most number.

Which is the second number from the right?
(A) 2 (B) 4 **(C) 7** (D) 10

Solution: 10 5 4 7 2
So, second from right will be 7.

Q.3 In a country of 1400 million population, 70% own mobile phones. Among the mobile phone owners, only 294 million access the Internet. Among these Internet users, only half buy goods from e-commerce portals. What is the percentage of these buyers in the country?
(A) 10.50 (B) 14.70 (C) 15.00 (D) 50.00

Solution: Number of people who having own mobile phones
= 70% of 1400 = 0.7 x 1400 = 980 million
Number of people who have access of internet = 294 million
Number of people who buy goods from e-commercial portals = half of interest users
= $\frac{294}{2}$ = 147 million
Percentage buyers = $\frac{147\ million}{1400\ million}$ x 100% = 10.5% Answer (A)

Q.4 Two trains started at 7AM from the same point. The first train travelled north at a speed of 80km/h and the second train travelled south at a speed of 100 km/h. The time at which they were 540 km apart is_____ AM.
(A) 9 (B) 10 (C) 11 (D) 11.30

Solution: According to the concept of relative sped in opposite direction, speed should be added:
Time of activity = Sum of distance/ Sum of speeds = 540/(100+80) = 540/180 = 3 hours from 7 am = 10 am Answer

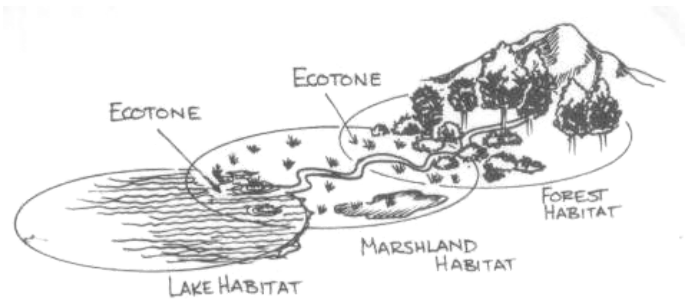
Q.5 The illumination level of a room is 300 lux and the efficacy of the lamps is 60. The Light Power Density (LPD) of the room in Watt/m^2 is _____.

Solution: Illumination, E = 300 lux = 300 lumen/sqm
Efficacy = 60 lumen/watt
LPD = Illumination / Efficacy = (300 lumen/sqm) / (60 lumen/Watt) = 5 Watt/sqm Answer
Tips: Please solve this type of question with numerical value and unit attached.

Q.6 The load on a RCC column is 150 kN. The soil bearing capacity is 80 kN/m^2. Assuming a factor of safety of 1.2, the side of the square column footing is _____ meter *(rounded off to one decimal place).*

Solution: Load on column = 150 kN
Design load consisting factor of safety = 150 * 1.2 = 180 kN
Soil bearing capacity = 80kN/m^2
Let side of the square column footing be S

The ecotone is visually very dramatic when viewed from up in the air, say from inside an airplane or via satellite images. Answer (D) Ecotone
(Source: https://www.maximumyield.com/definition/2220/ecotone)



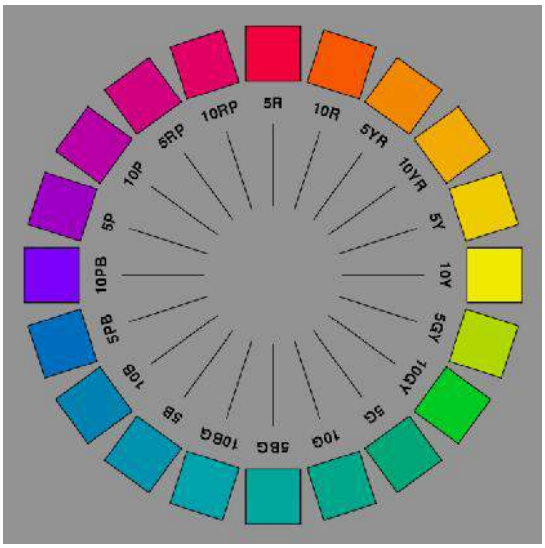


Figure: Twenty hues of the Munsell color system at maximum chroma to stay in the sRGB gamut.

Q.40 Complementary colours in a Munsell pigment colour wheel refers to
(A) Colours in alternate positions
(B) Colours opposite to one another
(C) Colours adjacent to each other
(D) A pair of secondary colours

Q.41 The closing syntax, for an executable command line in C or C++ program, is (A) : (B) , **(C) ;** (D) .

Q.42 The term 'Necropolis' refers to
(A) Organically growing settlement
(B) Origin of a settlement
(C) A dead settlement
(D) Merging of two settlements

Notes: The word **necropolis** derives from Ancient Greek: *nekro* meaning dead, and *polis* meaning city. *Nekropolis* thus is literally translatable as "City of the Dead." Later it was assimilated into Latin without any significant change before being taken up by the English Language.
The word is often used with a different connotation in fantasy literature; for instance, it might refer to a city populated by zombies or other undead creatures.
History and purpose: Necropolises were built for many reasons. Sometimes their origin was purely religious, such as in the case of the Valley of the Kings in Egypt in which many Pharaohs, who were considered to be Gods incarnate, were entombed. Other cultures created necropolises in response to prohibitions on burials within city limits. In the Roman Empire, roads immediately outside towns came to be lined with funerary monuments. Examples of this kind of necropolis can be found on the Appian Way just outside Rome and at the Alyscamps in Arles, France. Simple cemeteries took the place of larger, more elaborate necropolises during the Middle Ages, but in the nineteenth century, necropolises enjoyed a revival spurred by the Victorian fashion for large, elaborate memorials.
Necropolises are still created and used to this day, such as the one found in Colma, California. This suburb of San Francisco has been used for decades to bury the dead of San Francisco, as well as those of other nearby towns. The citizens had felt it necessary to bury the dead outside of city limits, and perhaps out of sight as well. Colma has become more of a working-class suburb, but the dead still outnumber the living in this small town. Answer (C) A dead settlement
(Source: http://www.newworldencyclopedia.org/entry/Necropolis)

Q.43 Which of the following projection types is adopted in the Universal Transverse Mercator (UTM)?
(A) Spherical (B) Conical (C) Planar (D) Cylindrical

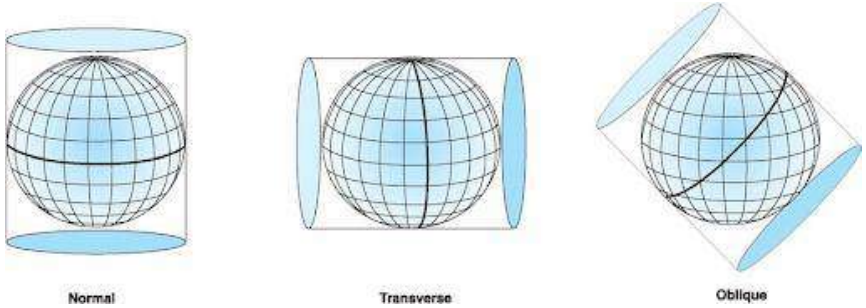


Figure: The Normal Mercator uses an upright cylinder for its map projection. The Transverse Mercator takes uses a horizontal cylinder, as pictured above – which is how the term "transverse" is derived.

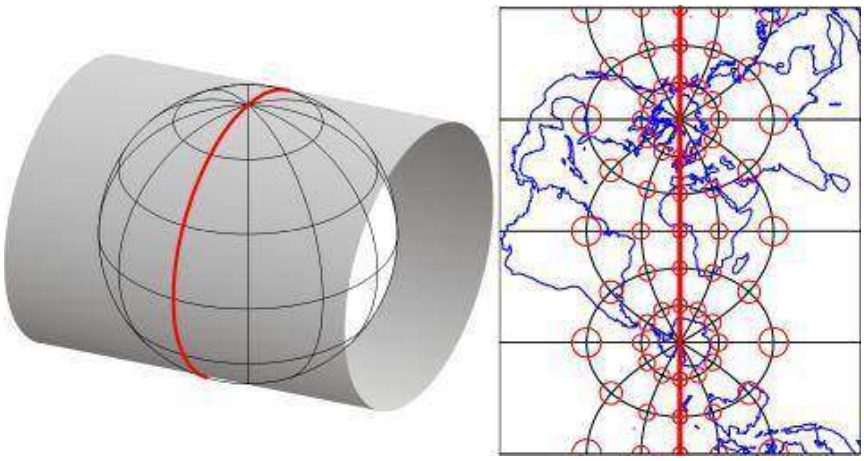


*Figure: The map above represents a Transverse Mercator projection of the world with a standard meridian at 0° longitude. (Note that because of the very small size of the map, the graticule is shown at 30° resolution that means there should be 60 lines on the globe but we have shown on 12 lines. 30° x 12 lines = 360° which surrounds the globe). The globe wrapped in a cylinder is a conceptual model of how the Transverse Mercator projection formula transfers positions on the globe to positions on a plane (The cylinder can be flattened to a plane surface after it is unwrapped from the globe.) The thicker red line on the cylinder and the map is the **standard line** along which scale distortion is zero. As the distortion ellipses on the map indicate, distortion increases with distance from the standard line. Red circles reveal the scale distortion introduced during the transformation from geographic to projected plane coordinates. On the globe, all the circles would be the same size.*

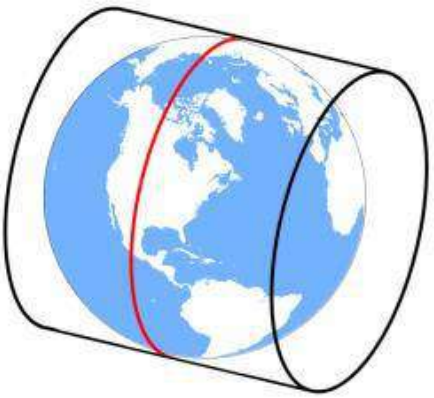


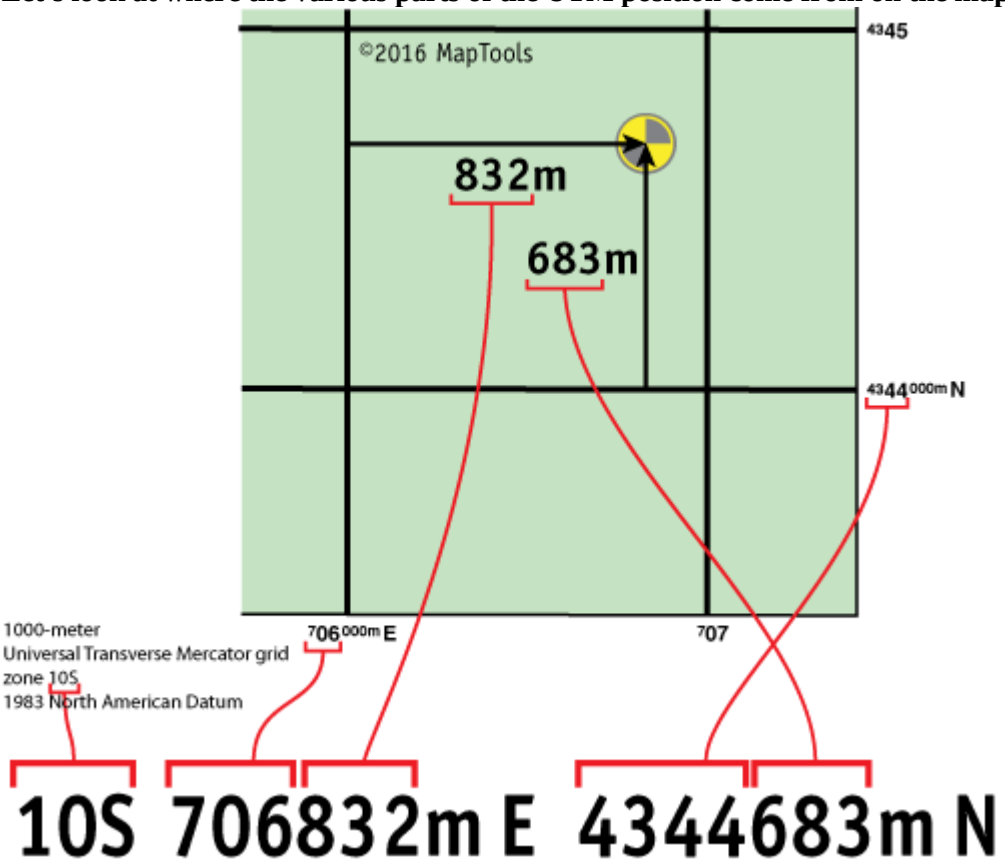
*Figure: The Universal Transverse Mercator places this cylinder **60 times for each UTM zone**. This means that all 60 wedges are flattened out with a transverse cylinder. Each time it's slightly rotated using a different meridian as a central line.*

A Quick Guide to Using UTM Coordinates

Standing at the center of the marker shown on the map below, a GPS unit set to display position in UTM/UPS format, would report a location of:

Location
10 S 0706832
UTM 4344683

Let's look at where the various parts of the UTM position come from on the map.



The map has grid lines spaced every kilometer or 1000 meters. The grid is labeled with UTM coordinate values. The vertical grid lines determine East-West position and the horizontal grid lines determine North-South position. Look along the bottom edge of the map at the labels for the vertical grid lines.

K. Snelson describes tensegrity as a closed structural system composed of a set of three or more slender compression struts within a network of tensioned tendons, the combined parts mutually supportive in a way, that the struts do not touch one another, but press outwardly against nodal points (vertices) in the tension network to form a firm, triangulated, prestressed, tension and compression unit. In short, he defined tensegrity as discontinuous compression, continuous tension structures. Probably the most complete definition of tensegrity structures is presented in as 'Tensegrity is a structural principle based on the use of isolated components in compression inside a net of continuous tension, in a way that the compressed members (usually known as bars/struts) do not touch each other and the prestressed tensioned members (usually known as cables/tendons) delineate the system spatially'.

Biotensegrity, a term coined by Dr. Stephen Levin, is the application of tensegrity principles to biologic structures. Biological structures such as muscles, bones, fascia, ligaments and tendons, or rigid and elastic cell membranes, are made strong by the unison of tensioned and compressed parts. The muscular-skeletal system is a synergy of muscle and bone. The muscles and connective tissues provide continuous pull and the bones present the discontinuous compression. Even the human spine, which seems at first glance like a stack of vertebrae resting on each other, is actually a tensegrity structure.

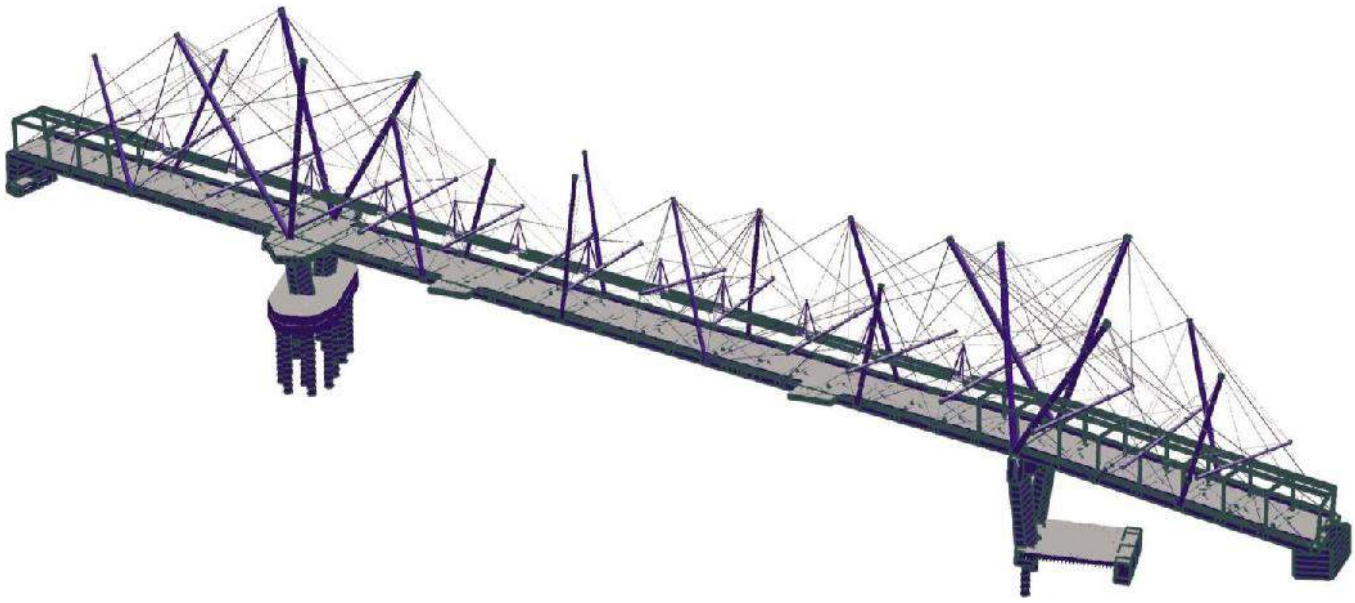


Figure: Kurilpa Bridge in Brisbane is one of the most famous hybrid tensegrity structures that people can use to traverse over a waterway. Its suspended by a series of crane-like pillars that use chords to hold the structure in place.

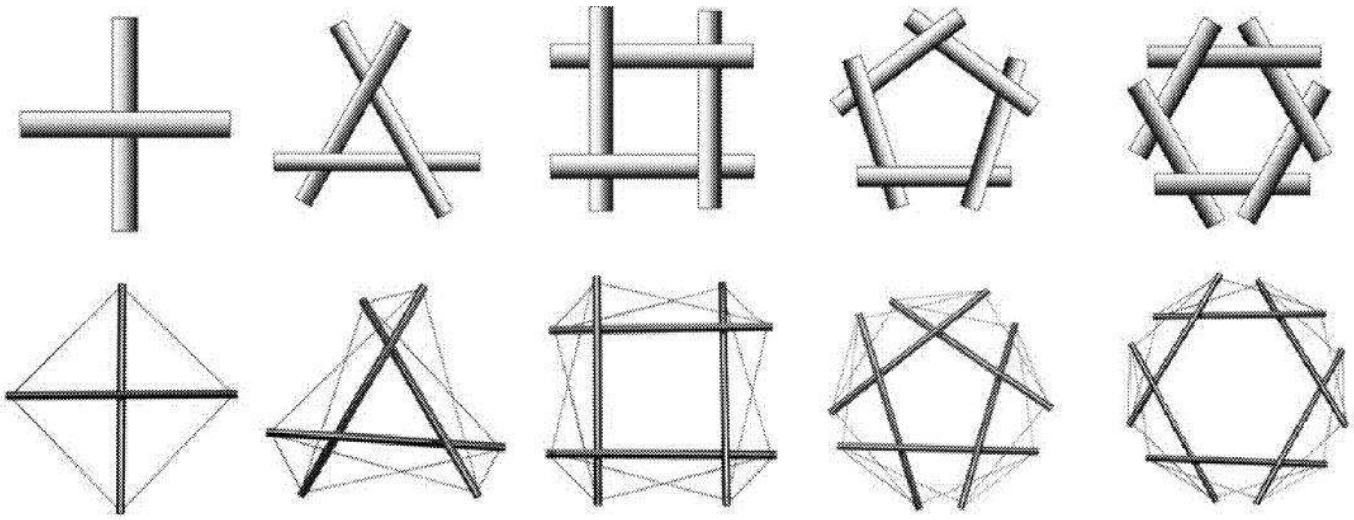


Figure: basic tensegrity modules and how it's made

https://pdfs.semanticscholar.org/517d/f1669841dfbe3d9316bbaa74104dfbb14638.pdf

Solution: Total load = (12+18)*1.5 = 45 ton
Bearing capacity = 10 ton/sqm
So, column footing area = (45 ton) / (10 ton/sqm) = 4.5 sqm Answer *(Official GATE answer varied from 4 to 5)*

Q.27 The indoor illumination requirement for a building is 350 Lux. If the daylight factor is 2.7 and the design sky illuminance is 9000 Lux, then the required supplementary artificial lighting is _____Lux.

Solution: D = (ei/eo)*100 2.7 = (ei/9000)*100 ei = 243
So, 350-243=107 lux Answer

Q.28 Two design options of a business building on a 10.0 hectare site are being compared for built up area. Floor to floor height of Option A is 3.6 m and that of Option B is 4.5 m. If the maximum allowable building height is 45 m with same ground coverage for both options, the additional built up area achievable in Option A over Option B is _____ percent.

Solution: Option A floor to floor height is 3.6 m
Option B floor to floor height is 4.5m
Therefore, No. of floor in option A is 45/3.6 = 12.5 = 12 floors
No. Of floor in option B is 45/4.5 = 10 floors
So additional built-up achieved by A = 20%

Q.29 "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

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. Answer (A)

Q.30 "In spite of being warned repeatedly, he failed to correct his _____ behaviour." The word that best fills the blank in the above sentence is (A) rational (B) reasonable (C) errant (D) good

Errant means misbehaving, exhibiting inappropriate behavior/offending conduct. Answer (C)

Q.31 In a Colour Wheel, Red and Blue colours are
(A) Tertiary (B) Complementary (C) Secondary (D) Primary

Notes: There are also definitions (or categories) of colors based on the color wheel. We begin with a 3-part color wheel.


Primary Colors


Secondary Colors


Tertiary Colors

Primary Colors: Red, Yellow and Blue (RYB)
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 (GOP)
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. Answer (D)

Q.32 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 Answer (C)

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.

Solution: **Option** (i) From the graph, we see that the curve flattens at around 100 min (37° C), while this happens at around 140 min for 25°C. This indicates a slowing down (but not a stop) earlier for 37°C. The growth stops (as per the graph) at 160 min for 37°C and 180 min for 25°C. So, even the stop in the growth occurs earlier at the higher temperature; (i) is true.
(ii) At 37°C, the concentration of 0.8 is attended at round 85 min. At 25°C, it is attained at around 125 min. This is much less than the twice 85 min; ii is false.
Hence, the correct option is (A)

Q.29 Match the architectural movements in Group-I with their proponents in Group-II.

GROUP I		GROUP II	
P.	Deconstruction	1.	Joseph Paxton
Q.	Historicism	2.	Kenzo Tange
R.	Metabolism	3.	Walter Gropius
S.	Art Nouveau	4.	Victor Horta
		5.	Frank O. Gehry

(A) P-5, Q-1, R-2, S-4 (B) P-5, Q-4, R-2, S-3 (C) P-5, Q-2, R-3, S-3 (D) P-2, Q-4, R-1, 5-5
If you knew Victor Horta, the question could have been so easy.
Art Nouveau is a French word meaning "New Art". Belgium was an early center of the art nouveau, thanks largely to the architecture of **Victor Horta**, who designed the first art nouveau houses, the Hôtel Tassel in 1893, and the Hôtel Solvay in 1894.

Answer: (A)

Q.30 The Pritzker Architecture prize for the year 2016 has been awarded to
(A) Alejandro Aravena (B) Frei Otto (C) Stephen Breyer (D) Yung Ho Chang

Figure: There are two photographs here. Aravena provided a concrete frame, with kitchen, bathroom and a roof (left), which were designed to allow families to fill in the gaps (right). So, the architect provided a basic concrete frame, complete with kitchen, bathroom and a roof, allowing families to fill in the gaps, and stamp their own identity on their homes in the process. Photograph: Cristobal Palma, Source: www.theguardian.com

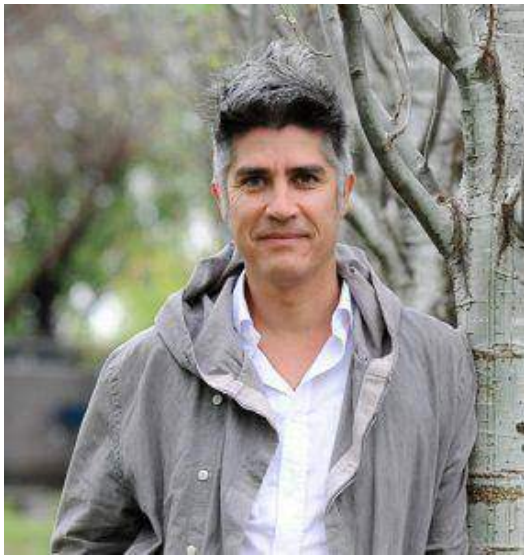


Figure: Pritzker Architecture Prize 2016 **Alejandro Aravena**

The architect Alejandro Aravena is from Chile. Runs a design firm ELEMENTAL. He is known his pioneering social housing projects in Latin America. **Answer: (A)**

Q.31 Match the classical urban planning theories in Group-I with their proponents in Group-II

GROUP I		GROUP II	
P.	Concentric Zone Model	1.	Beny and Horton
Q.	Sector Model	2.	Homer Hoyt
R.	Multiple Nuclei Model	3.	Ernest Burgess
S.	Factorial Ecology	4.	Shevky and Bell
		5.	Harris and Ullman

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

QUESTION BANK

2016 ~ 2012

PART2

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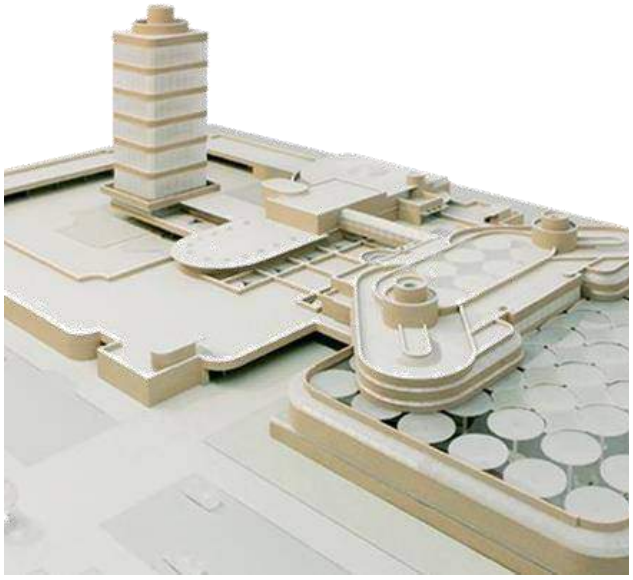


Figure: Johnson Wax Building by Frank Lloyd Wright. Mushroom column can be seen under the glass floor.

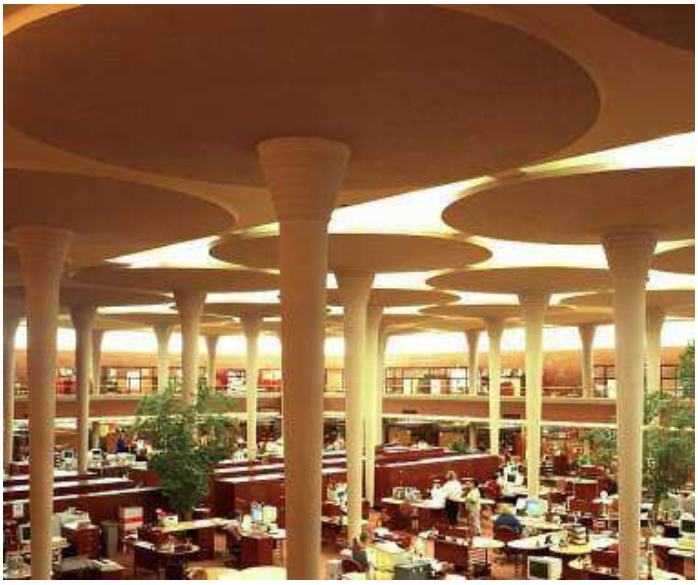


Figure: Inside view. Johnson Wax Building by Frank Lloyd Wright. Mushroom column.

The Chrysler Building is a classic example of the Art Deco style, from the street to its terraced crown. Interior and exterior alike, it is admired for its distinctive ornamentation based on features that were also found on Chrysler automobiles at the time.

It was interested in building the highest structure known to date. As this was the goal of most architects across the table, William Van Alen kept the 185-foot spire addition a secret until it was delivered to the site in sections to be erected in a surprising 90 minutes.

Figure: The Chrysler Building, New York

Spaces

At home Shodan pilotis lose the slenderness chasing the directionality of a ramp connecting seamlessly to the different areas of the building, housing space organizations.

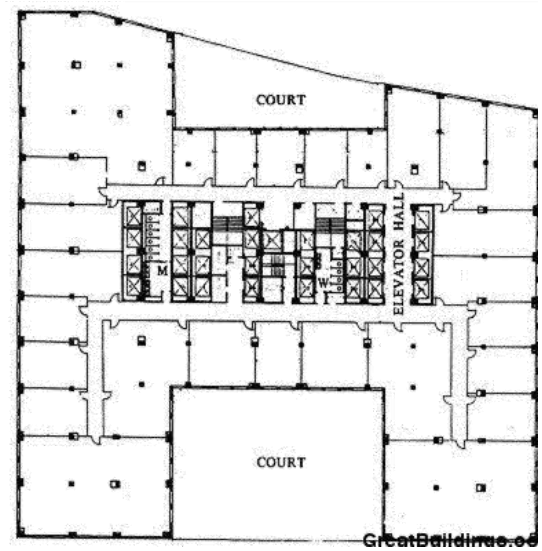


Figure: The floor plan, lower part of the Chrysler Building, New York.

Figure: The Eagle. Part of the Art Deco style of Chrysler Building.

Q39. Shodhan House, Ahmedabad was designed by (1 mark)

(A) Anant Raje (B) Le Corbusier (C) Louis I. Kahn (D) B. V. Doshi

The villa Shodan is the culmination of a lifetime of research and testing in the field of domestic architecture. In it, Le Corbusier, adapting them to resume their invariants "a tropical Indian"

Figure: Konark Wheel, **The Sun Temple** of Konark.

Architectural Glory of the Sun Temple

The Sun Temple e built in the thirteenth century was conceived as a gigantic chariot of Sun God, with twelve pairs of exquisitely ornamented wheels pulled by seven pairs of horses. Majestic in conception, this Temple is indeed one of the most sublime monuments of India, famous as much for its imposing dimensions and faultless proportions as for the harmonious integration of architectural grandeur with plastic allegiance. It is admittedly the best in Orissa. Its fine traceries and scroll work , the beautiful and natural cut of animal and human figures, all give it a superiority over other temples. The chief quality is its design and architectural details. The Sun temple belongs to the Kalinga School of Indian Temples with characteristic curvilinear towers mounted by Cupolas. In shape, the Temple did not make any major departure from other Sikhara temples of Orissa. The main sanctum which (229 ft. high) was constructed alongwith the audience hall (128 ft. high) having elaborate external projections. The main sanctum which enshrined the presiding deity has fallen off. The Audience Hall survives in its entirely but of the other two viz the Dancing Hall (nata Mandir) and the Dining Hall (Bhoga-Mandap), only small portions have survived the vagaries of time. The Temple compound measures 857 ft. by 540 ft.

The alignment of the Sun Temple is on the east-west direction. The Temple is located in natural surroundings, abounding with casuarina plantations and other types of trees, which grow on sandy soil. The environment is by and large unspoiled. Gentle undulating topography around the Sun Temple lends some variation to the landscape.

Answer: B

37. Match the monuments in Group-I with their Features in Group-II

Group-I
P Pisa Cathedral, Italy
Q St. Hagia Sophia, Istanbul
R Great Temple of Aman, Karnak
S. Cathedral of Notre Dame, Paris

Group-II
1 Gothic
2 Moorish
3 Egyptian
4 Byzantine
5 Romanesque

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

Figure: The **Pisa Cathedral, Italy**

Figure: **Hagia Sophia**

Notes: **Pisa Cathedral, Italy** a medieval cathedral, entitled to Santa Maria Assunta (St. Mary of the Assumption). Construction began in 1063 by the architect Buscheto to celebrate breaking the Saracen fleet off Palermo in 1063. The work was carried over to the architect of the 12th century, Rainaldo. The dome was completed in the 14th century.

The Cathedral is Latin cross-shaped when it's viewed from above. 95m in lenght, 32m in width, it is called Pisan Romanesque masterpiece.
Interior is divided into five naves by densely lined 68 cylinders. It's said that many of those cylinders were taken as booty from the ancient ruins of Palermo. The mosaics of the interior show a strong Byzantine influence, while the pointed arches point to Muslim influences.

were no requirements in terms of drawings or models to be produced; rather, the architects were only asked to present what they thought would convey their concept for the new museum.

Figure: **Guggenheim Museum, Bilbao**

Almost from the moment it opened in 1997, Gehry's Guggenheim Museum Bilbao, with its distinctive titanium curves and soaring glass atrium, was hailed as one of the most important buildings of the 20th century. Gehry's use of cutting-edge computer-aided design technology enabled him to translate poetic forms into reality. The resulting architecture is sculptural and expressionistic, with spaces unlike any others for the presentation of art. The museum is seamlessly integrated into the urban context, unfolding its interconnecting shapes of stone, glass, and titanium on a 32,500-square-meter site along the Nervión River in the old industrial heart of the city.

Eleven thousand square meters of exhibition space are distributed over nineteen galleries. Ten of these galleries have a classic orthogonal plan and can be identified from the exterior by their stone finishes. Nine other irregularly shaped galleries present a remarkable contrast and can be identified from the outside by their swirling forms and titanium cladding. The largest gallery, measuring 30 meters wide and 130 meters long, was used for temporary exhibitions for several years. In 2005, it became the site of the largest sculpture commission in history, Richard Serra's monumental installation The Matter of Time.

The Guggenheim Museum Bilbao is a pinnacle in Gehry's outstanding architectural career as well as in the field of museum design. It remains unsurpassed in its integration of art and architecture, maintaining an aesthetic and programmatic unity.

57. A five storey building is constructed on a 100 m x 50 m plot having coverage of 60% (option 1). Alternatively, a four storied building is constructed on the same plot with a 50% ground coverage (option2). The ratio of FARs between options1 and 2 is _____ Answer : 1.5

Solution: FAR = Total built up area/ Plot area
Total built up area in option 1 = (coverage area) X (no. of floors) = (100x50x0.6) X (5) = 15000
Total built up area in option 2 = (coverage area) X (no. of floors) = (100x50x0.5) X (4) = 10000
Plot area is common for both options = 100x50 = 5000 sqm
So, FAR 1/FAR 2 = [15000/5000]/[10000/5000] = 1.5 Answer

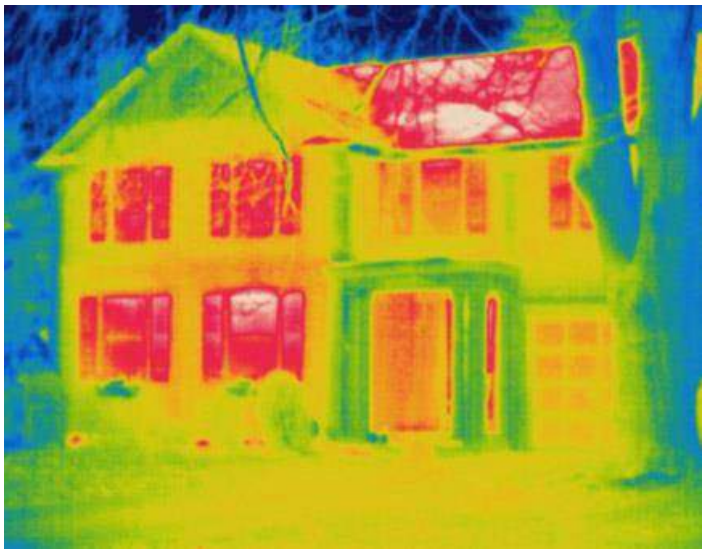


Figure: Infrared mapping. Most household heat is lost through the windows and roof as shown in the figure.

58. If a roof is treated with a layer of thermal insulation material, the internal heat gain is reduced by 60%. The U-value of the roof (without thermal insulation) is 3 Wm2/degree centigrade. Assuming a constant temperature difference between indoor and outdoor, the U-value of the thermal insulation layer in Wm2/degree centigrade is_____ Answer : 2

Solution: We know,
$\frac{1}{Uo} = \frac{1}{U_1} + \frac{1}{U_2} + \frac{1}{U_3} + \dots$
As per question,
Uo = Reduced by 60% of 3 Wm^2/degree centigrade = 40% of 3 Wm^2/degree centigrade = 1.2 Wm^2/degree centigrade
U_1 = 3 Wm^2/degree centigrade
U_2 = x Wm^2/degree centigrade
Therefore,
$\frac{1}{1.2} = \frac{1}{3} + \frac{1}{U_2}$

⇨ $\frac{1}{U_2} = \frac{1}{1.2} - \frac{1}{3} = \frac{1.8}{3.6}$
⇨ $\frac{1}{U_2} = \frac{1.8}{3.6}$
⇨ U_2 = 2 Wm^2/degree centigrade **Answer**

Alternative solution:
We will start from the beginning with concept.
U-value = 1/ R-value
Following is the basic equation of heat flow,
$\frac{\Delta Q}{\Delta t} = k\frac{A(T_f - T_i)}{L}$ ……(1)
Where,
$\frac{\Delta Q}{\Delta t}$ is rate of heat flow
k = Thermal conductivity coefficient
A= surface area of the wall
L= wall thickness
T_f-T_i = temperature difference

R-value is inversely related to the thermal conductivity constant and is also related to thickness, thus:

Grafting or **graftage** is a horticultural technique whereby tissues from one plant are inserted into those of another so that the two sets of vascular tissues may join together. This vascular joining is called inosculation. The technique is most commonly used in asexual propagation of commercially grown plants for the horticultural and agricultural trades.
In most cases, one plant is selected for its roots and this is called the **stock** or rootstock. The other plant is selected for its stems, leaves, flowers, or fruits and is called the **scion** or **cion**. The scion contains the desired genes to be duplicated in future production by the stock/scion plant.

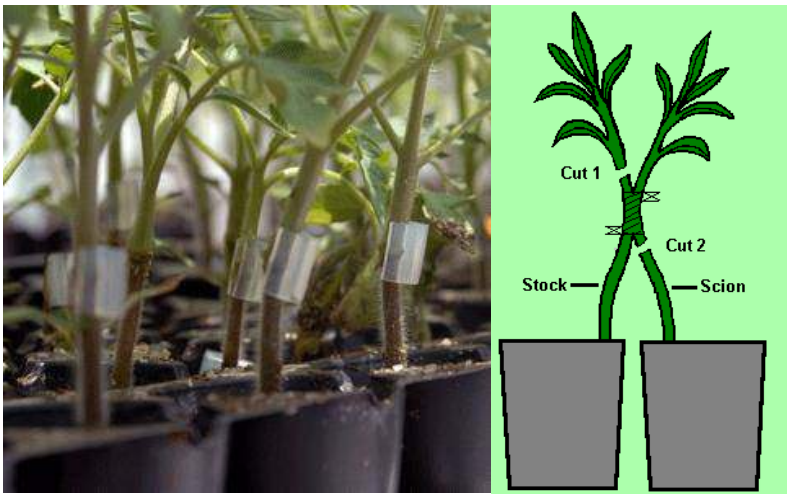


Figure: **Grafting**

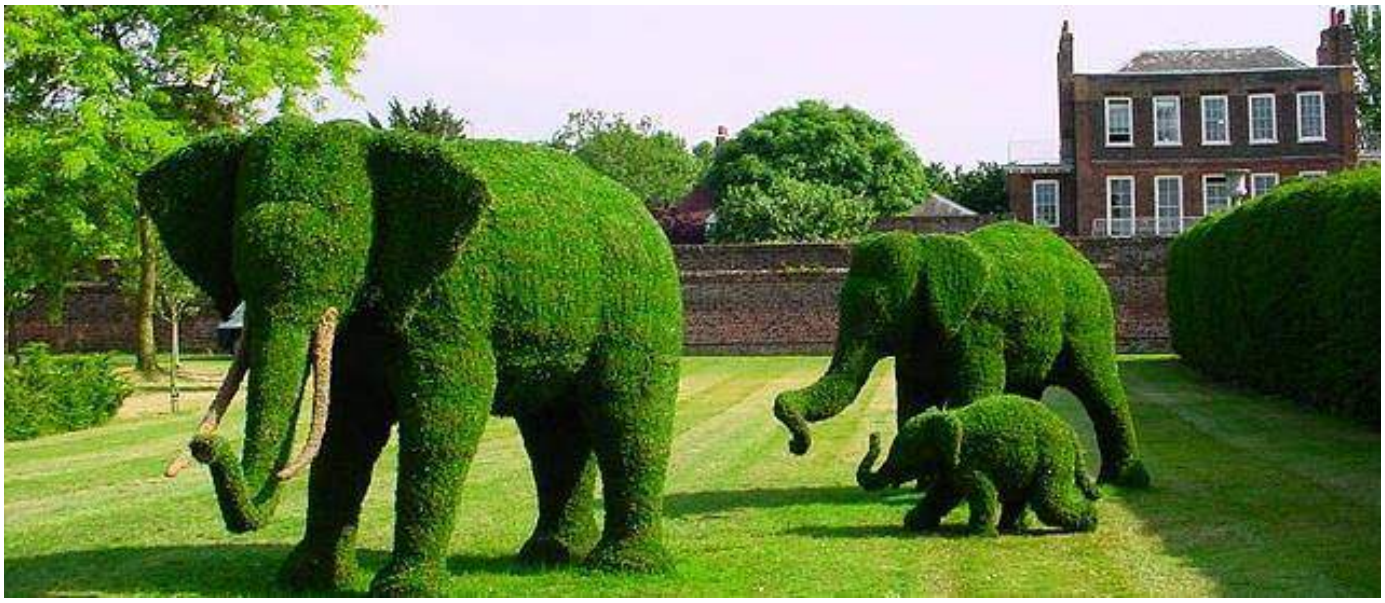


Figure: **With Topiary technique**, complex shape can be achieved.

Q.61 Assuming full compaction, strength of concrete is inversely proportional to
(A) Water - cement ratio (B) Water - sand ratio (C) Water - coarse aggregate ratio (D) Water - plasticiser ratio
Answer (A)

Q.62 Match the terms in Group I with their examples in Group II

Group I	**Group II**
P. Incentive zoning	1. Boardwalk, Atlantic City
Q. Universal design	2. Minneapolis, USA
R. Promenading	3. Broadway Theatre District, New York
S. Skyway system	4. Pruitt Igoe Housing, St. Louis, Missouri
	5. Curitiba, Brazil

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

Q.63 Match the books in Group I with their authors in Group II

Group I	**Group II**
P. Architecture Now!	1. Ian Mc Harg
Q. Intentions in Architecture	2. Robert Venturi
R. Design with Nature	3. Christopher Alexander
S. Complexity & Contradictions in Architecture	4. Philip Jodidio
	5. Christian Norberg Schulz

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

Answer (B)

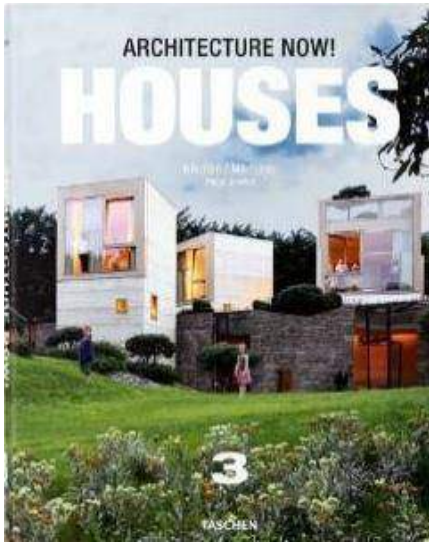


Figure: Architecture Now! by **Philip Jodidio**

The Architecture Now! series is an ongoing project documenting the work of the most innovative and influential architects across the globe. This special edition of selection from Volume 5 features famous names and newcomers alike, and this time around a number of designers are also included, reflecting the new ways in which design and architecture are coming together. Since architecture also extends beyond walls, landscape architecture makes its appearance as well. Easy-to-navigate illustrated A–Z entries include current and recent projects, biographies, contact information, and web sites.

The author:Philip Jodidio studied art history and economics at Harvard, and edited *Connaissance des Arts* for over 20 years. His books include TASCHEN's *Architecture Now!* series, and monographs on Tadao Ando, Norman Foster, Richard Meier, Jean Nouvel, and Zaha Hadid. He is internationally renowned as one of the most popular writers on the subject of architecture.

Norberg-Schulz is a practicing architect ;his buildings stand in several countries;and he elucidates the nature of architectural reality with a practiced eye and from a practicalviewpoint. Although the methods and theory that his book develops are uncompromisingly rigorous and tightly formed, they are everywhere related to actual building, through specific examples and through the use of over 100 photographs. The structure that Norberg-Schulz has fashioned is surely one of the most impressive intellectual edifices that any architect has ever produced. The materials that are organically worked into it include Gestalt psychology, the mechanics of perception, information theory, modern analytic philosophy, and in particular, linguistic analysis, and the general theory of signs and symbols. The result, however, is not an eclectic hodge-podge ;all these materials have their place and purpose ;none is applied extraneously for "show" or purely decorative effect. And all this divergent material had to be joined according to plan within formal bounds in order to produce a theory with equally divergent applications: one that can treat not only of the aesthetics of architecture but equally well of its social, psychological, and cultural effects. The chief focus of the book is on the symbolic and linguistic. The purpose is to develop an integrated theory of architectural description and architectural intention (and this includes the intention of the user as well as that of the designer), insofar as architecture is an art.

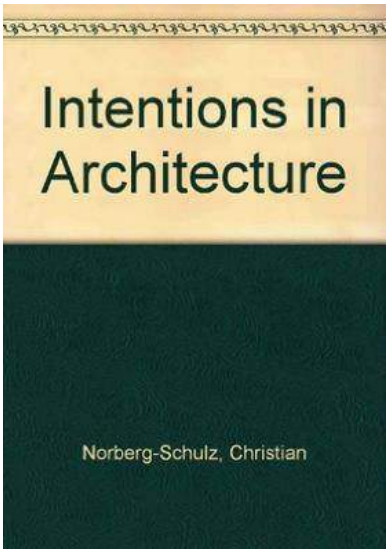


Figure: Intentions in Architecture by Christian Norberg Schulz

'Complexity and contradiction in architecture' expresses in the most compelling and original terms the postmodern rebellion against the purism of modernism. Three hundred and fifty architectural photographs serve as historical comparisons and illuminate the author's ideas on creating and experiencing architecture.

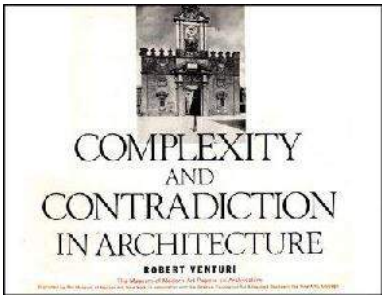


Figure: 'Complexity and contradiction in architecture' by Robert Venturi

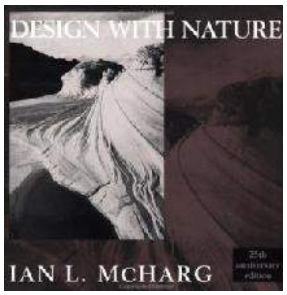


Figure: Design with Nature by Ian Mc Harg

The first book to describe an ecologically sound approach to the planning and design of communities, **Design with Nature** has done much over the past 25 years to shape public environmental policy. This paperback edition makes this classic accessible to a wider audience than ever before. Lavishly illustrated with more than 300 color photos and line drawings.

Q.64 Match the common names of the trees in Group I with their botanical names in Group II

Group I	**Group II**
P. Gulmohar	1. Dalbergia Sissoo
Q. Palash	2. Ficus Benghalensis
R. Indian Mahogany	3. Delonix Regia
S. Banyan	4. Toona Ciliata
	5. Butea Monosperma

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

GATE 2013

Section 1: Numerical Questions

Q.1 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

Solution: dB = 10log(100I/I) =10log100 = 10*2 = 20 Answer
Thumb rule: log10 = 1, log 100 = 2, log1000 = 3 (All base 10)

Q.2 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

Solution:
The required ratio is = $\frac{Width\ of\ Front\ Facade\ of\ the\ Parthenon}{Height\ of\ the\ Parthenon\ without\ Pediment}$

$= \frac{AB}{CD} = \frac{1.618}{0.618} = 2.6$
Which is approximately equal to $\frac{9}{4} = 2.2$
(Nearest to the given option A)
Please note that in figure, GABE is a rectangle of golden ratio and GADH is a square. Similarly, HDBE is a rectangle of golden ratio and DBFC is a square

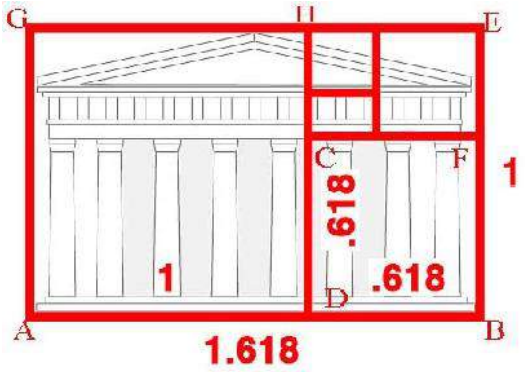


Figure: The Parthenon & the golden ratio

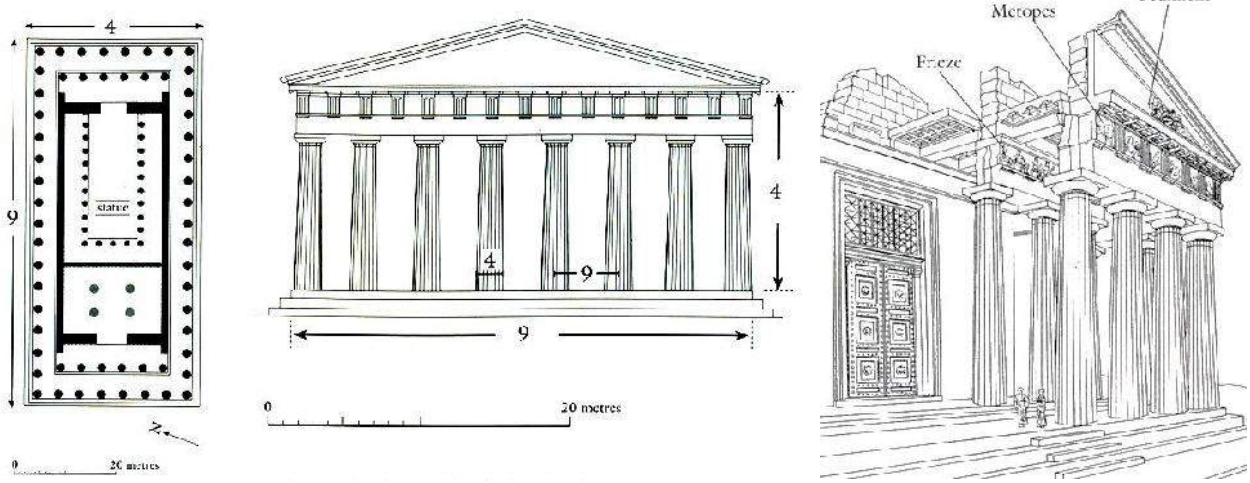
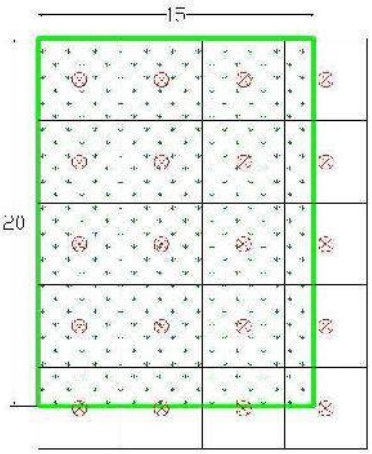


Figure: The Parthenon, it's layout and the triangular part called Pediment as shown.

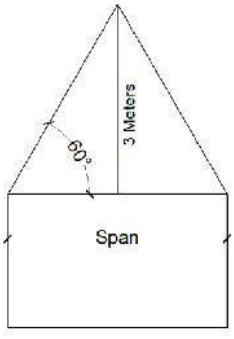
Q.3 If the area coverage of one sprinkler is 20 m^2, with a maximum and minimum spacing of 4.6 m and 1.8 m respectively, the minimum number of sprinklers required to be arranged in a regular orthogonal grid to cover the area of a 15 m x 20 m room would be _____.

Solution: For minimum no. of sprinklers, the spacing between them should be maximum. Let us assume, shape of area coverage of the sprinkler is square. As area coverage of one sprinkler is 20 m^2, so the side of the square = square root 20 = 4.47 which also satisfies 1.8 < 4.47 < 4.6

Now, let's arrange the sprinkler on the plot of 15m x 20m as shown in the figure.
Along 20m length, 5 sprinklers can be arranged and along 15m width, 4 sprinklers can be arranged. So total no. of sprinklers = 5*4 = 20 Answer.



Q.4 If the slope of a hipped roof is 60 degrees and height of the roof is 3 m, span of the room, in m, would be _____.



Solution: Span of the room = 2 x (3/tan60°) = 2 x (3/√3)
= 2*√3 = 3.46 Answer
The official GATE answer range is 3.4 to 3.6

Q.5 Volume of coarse aggregate in m3 present in 1.0 m3 of 1 : 1.5 : 3 concrete mix made by volume batching is _____.

QUESTION BANK

2011 ~ 2006

PART3

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GATE ARCHITECTURE

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~ Review of the Question Paper of GATE in Architecture & Planning with Essential Notes ~

(2011 ~ 2006)

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GATE 2011

Section 1: Numerical Questions

Q1. The minimum road curb length required for parking 10 cars perpendicular to the road is
(A) 15 m (B) 25 m (C) 35 m (D) 40 m

Solution: The minimum road curb length required for parking 10 cars perpendicular to the road is 25m.
Notes:*2.5m wide for 1 car if row parking is provided otherwise 3.0m wide for individual car park.*
Street Parking: if N = Number of cars parked, L = Length of parking bay, then for:
Parallel Parking: L = N
30° Parking: L = 0.58 + 5N
45° Parking: L = 3.54 N + 1.77
60° Parking: L = 2.89N + 2.16

Scan to read more on Street Parking

Q2. Maximum horizontal angle from the speaker in a seating area of a lecture theatre should be
(A) 70° (B) 90° (C) 120° (D) 140°

Q3. A room measuring 5 m x 3.5 m enclosed by brick wall has a ceiling at 3 m height. The room has a door and a window opening of 1 m x 2 m and 1 m x 1 m respectively. The quantity of plastering required for interior walls (in sqm) is
(A) 46.5 (B) 48 (C) 51 (D) 68.5

Solution: Surface area of 4 interior walls = 2(5+3.5) x 3 = 51sqm
Surface area of door = 1m x 2m = 2sqm
Surface area of window= 1m x 1m= 1sqm
So, net surface area for plastering = 51-2-1= 48 sqm Answer

Q4. One cubic metre of Ordinary Portland Cement yields a volume of M15 concrete in the range of
(A) 2 to 3 cum (B) 4 to 5 cum (C) 7 to 8 cum (D) 8 to 9 cum

Solution: Nominal Mix Concrete: In the nominal mix concretes the constituents of concrete are measured by volume and the proportions are pre- determine such as 1:8:16, 1:4:8 1;3;6 and 1:2;4 etc. The unit of measurement of cement is a bag of 50 kg having a volume of 0.035 cum. The batch boxes are made with the size 35x25x40cm which corresponds to one bag of cement. Nominal mix concretes 1:5:10, 1:4:8, 1:3:6, 1:2:4 and 1;1.5; 3 roughly correspond to M5, M7.5, M 10,M15 and M20 grades of concrete so far as their compressive strength is concerned.
M15 = 1:2:4 (cement:stone:sand)
So, for 1cum of cement will require 2 cum of sand and 4 cum of coarse aggregate. Total 1+2+4 = 7 cum of concrete will be required. Also note that the volume of concrete is reduced by a factor of 1.54. Therefore, effective volume of the concrete would be = **7/1.54 = 4.54 cum Answer.**
What is M15: It is designation of grades of concrete mix. Letter M refers to the mix and number to specified characteristic compressive strength of 15 cm cube at 28 days expressed in N/square mm. Thus M 15 concrete means a concrete of characteristic strength 15N/square mm. Grades of concrete lower than M 15 shall not be used in reinforced concrete.

Q5. A site in a map drawn to scale of 1:16000 measures 75 sqcm. The actual area of the site in hectares is
(A) 120 (B) 162 (C) 192 (D) 256

Solution: 75 sqcm = √75cm x √75cm
So, actual area = (√75cmx16000) x (√75cmx16000) = (√75x160m)x (√75x160m) =192 hectares {1hectare=100mx100m}

Q6. In a construction project schedule, A is the first activity. Activities B and C follow A. Activity D follows B and C. Activity E follows C. Activity F follows D and E.

Activity	A	B	C	D	E	F
Duration(in days)	3	2	5	6	5	3

The critical time to complete the project will be
(A) 14 days (B) 16 days (C) 17 days (D) 20 days

Q7. The maintenance cost of a building will be Rs. 2 lacs after 10 years. The annual sinking fund required for such maintenance @ 6 % interest per annum will be
(A) Rs. 17,200/- (B) Rs. 15,200/- (C) Rs. 13,200/- (D) Rs. 11,200/-

Solution: Sinking Fund = (Maintenance Cost) / $[(1 + r)^n /r]$……{r = interest rate, n = no. of years
Sinking Fund = (200000) / $[\{(1 + 6\%)^{10} – 1\} /6\%]$
Sinking Fund = (200000) / $[(1 + 0.06)^{10}$ - 1 /0.06]
Sinking Fund = (200000) / $[(1.06)^{10}$ /0.06] = (200000) / [1.79 -1 /0.06] = (200000) / [0.79/0.06] = 200000 /13.167
Sinking Fund = **15189** Answer

Common Data Questions
Common Data for Questions 8 and 9:
Q8. A beam of span L is simply supported at two ends. One half span of the beam weighs W and the remaining half span weighs 2W. Maximum shear force in the beam will be

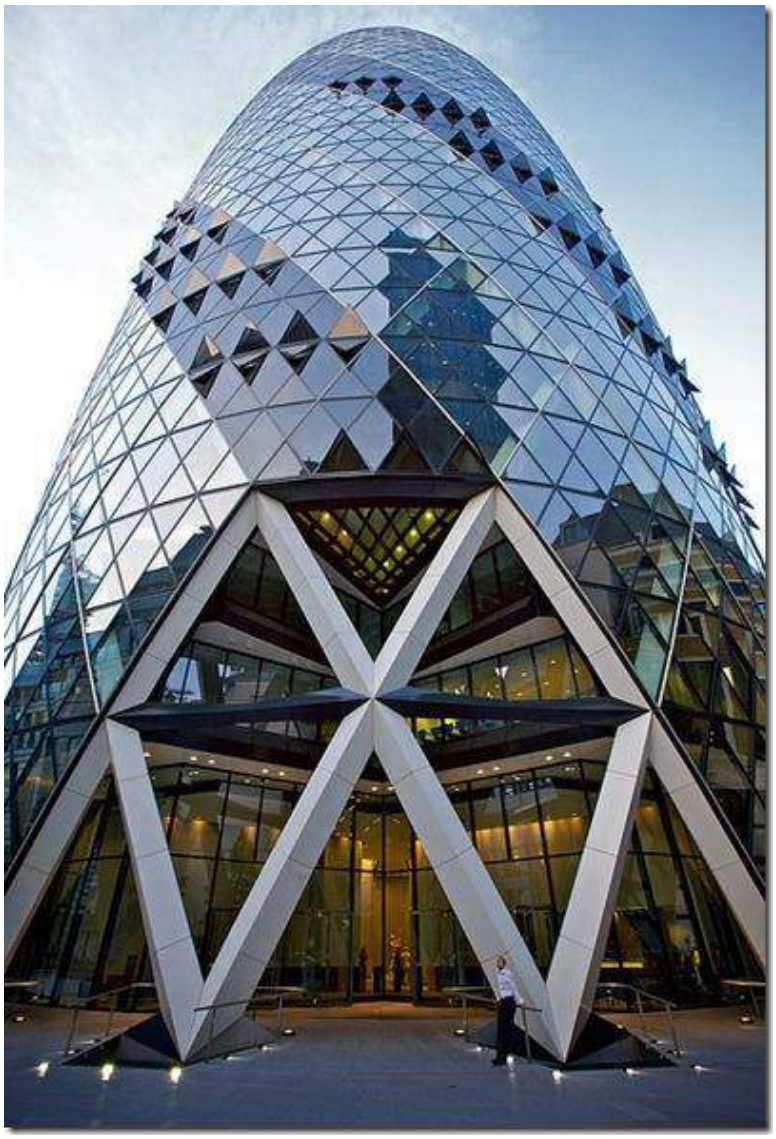


Figure: 30 St. Mary Axe London

Currently, it is Great Britain's most expensive commercial building (with office spaces). It has been sold at a mesmerizing price of £630 million .

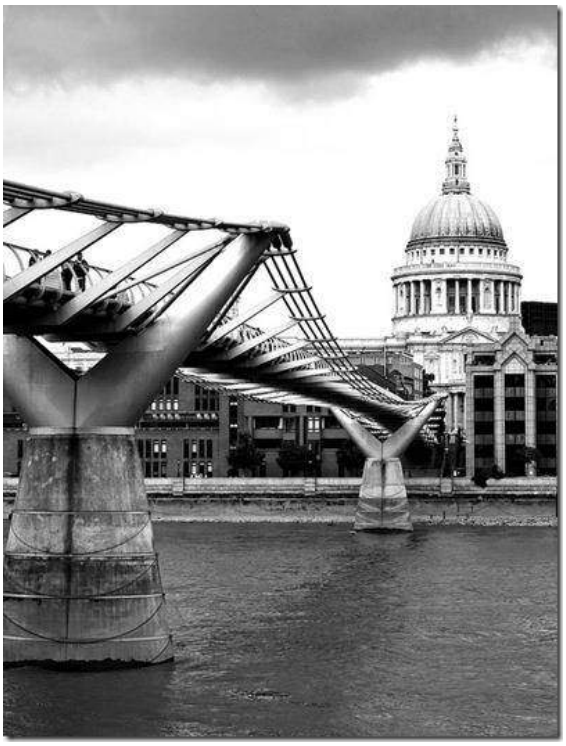


Figure: Millenium Bridge, London

Millenium Bridge, London

This suspension bridge opened to public on June 10th 2000, automatically becoming a landmark of the new millennium. The structure is 325 meters long, is made of steel, and has a 4-metre wide aluminium deck. The design of the bridge allows a very good visibility of the River Thames and the surroundings, because the suspension cables are placed below deck level, instead of hanging up in the air. When Foster and Partners, Arup and Anthony Caro entered the competition with their design, the project was called "The Blade of Light".

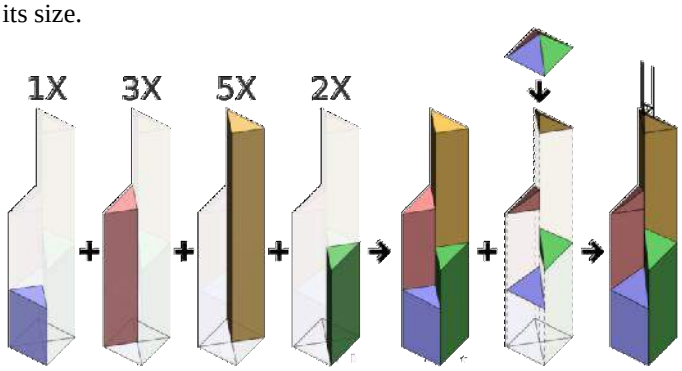
Free University, Berlin

This university is among the top 3 academic institutions in Germany, where social and natural sciences research and doctoral programs are conducted. Its construction took around 8 years until final completion (1997-2005), and given its oval egg-shape like design, some call it a fine piece of "Eggchitecture".

Some critics argue that the ultra modern library building with curved shapes, does not match the rectangular, traditional structures that one can find on campus. However, the entire project seems to have fitted in perfectly, being a symbol for change, future and environmentally friendly strategy implementations.

Figure: Free University, Berlin

The Bank of China Tower: Triangular bracing and step-backs are structural adaptations to the high wind loads caused by Hong Kong typhoons.
369 meters high, 72 floors
When commissioned to design the Bank of China Tower, I.M. Pei wanted to create a structure that would represent the aspirations of the Chinese people yet also symbolize good will toward the British Colony. Original plans included an x-shaped cross-brace. However, in China the X shape is seen as a symbol of death. Instead, Pei opted to use less threatening diamond forms.
Another symbol used for this building is that of the bamboo plant, which represents revitalization and hope. The sectioned trunk of the Bank of China Building is inspired by the growth patterns of bamboo.
The four triangular shafts which form the building grow more narrow as the building rises. These shafts support the weight of the building and eliminate the need for many internal vertical supports. Consequently, the Bank of China uses less steel than typical for a building its size.



Scan here for further reading on **Bank of China Tower**

Figure: **The Bank of China Tower.**

The prism-like façade of the 367.4m Bank of China Tower has become one of Hong Kong skyline's most recognisable and appreciated features. The work of renowned Chinese–American architect I.M. Pei, the 70-storey building's asymmetrical form is pure geometry and has been compared to a bamboo plant, which extends its trunk successively higher with each new burst of growth. Answer: (D)

Q45. Match the CAD commands in Group I with their functions in Group II.

Group I		Group II	
P.	LAYISO	1.	blends selected object to destination layer
Q.	LAYMCH	2.	freezes layer of selected object
R.	LAYMRG	3.	hides or locks layers other than those of selected objects
S.	LAYLCK	4.	assigns selected object to destination layer
		5.	locks object of destination layer

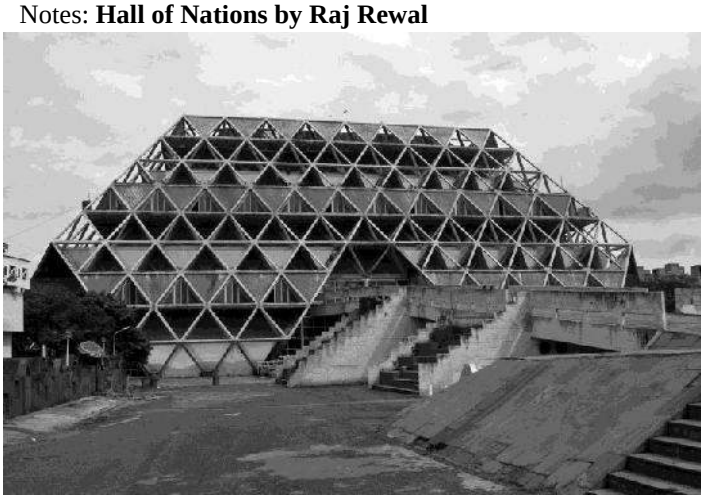
(A) P-2, Q-4, R-1, S-5 (B) P-3, Q-2, R-1, S-5 (C) P-4, Q-2, R-3, S-5 (D) P-3, Q-4, R-1, S-5
Answer: (D) The most appropriate answer. MARKS to ALL

Q46. Match the buildings in Group I with their corresponding structural forms in Group II.

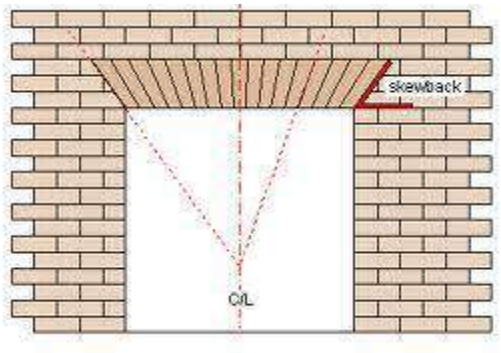
Group I		Group II	
P.	Hall of Nations, New Delhi	1.	Spherical Structure
Q.	Salvacao Church, Mumbai	2.	Folded Plates
R.	State Trading Corporation Building, New Delhi	3.	Octahedral lattice structure
S.	Matrimandir, Auroville	4.	Vierendeel girders
		5.	Shell roof structure

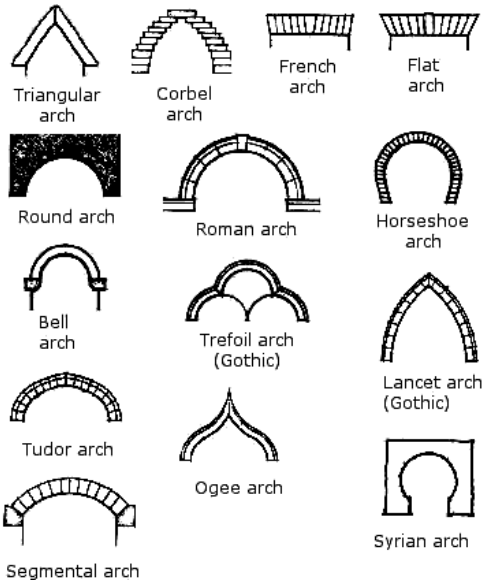
(A) P-3, Q-5, R-4, S-1 (B) P-2, Q-5, R-4, S-1 (C) P-3, Q-5, R-4, S-2 (D) P-3, Q-5, R-2, S-1

Notes: **Hall of Nations by Raj Rewal**



The Permanent Exhibition Complex is designed to form the focus of 130 acres of Exhibition ground designed by Raj Rewal in New Delhi. The design was evolved to meet the constraints of time, availability of materials and labour, but above all, to reflect symbolically and technologically, India's intermediate technology in the 25th year of its independence. The depth of the structural system was utilized as a Sun breaker and conceived of in terms of the traditional 'jali', a geometrical pattern of perforation that





Answer: (C) 60 degree

Q.23 Primary colours of natural light are
(A) Red, Blue. Yellow (B) Red. Green, Blue
(C) Red. Violet. Yellow (D) Red. Green, Yellow

Notes: **Primary colors** are sets of colors that can be combined to make a useful range of colors. The primary colors are those which cannot be created by mixing other colors in a given color space.

For subtractive combination of colors, as in mixing of pigments or dyes for printing, the primaries normally used are cyan, magenta, and yellow though the set of red, yellow, blue is popular among artists.

For **additive combination of colors**, as in overlapping projected lights or in CRT displays, the primary colors normally used are red, green, and blue.
Primary colors are not a fundamental property of light but are related to the physiological response of the eye to light (the way the eye works). For humans, three primary colors are usually used, since human color vision is trichromatic.

Fundamentally, light is a continuous spectrum of the wavelengths that can be detected by the human eye, an infinite-dimensional stimulus space. However, the human eye normally contains only three types of color receptors, called cone cells. Each color receptor respond to different ranges of the color spectrum. Humans and other species with three such types of color receptors are known as trichromats.

Additive primaries
Media that combine emitted lights to create the sensation of a range of colors are using the additive color system. Television is the most common use of this.

The additive primaries are red, green, and blue. Because of the response curves of the three different color receptors in the human eye, these colors are optimal in the sense that the largest range of colors — a gamut — visible by humans can be generated by mixing light of these colors. Additive mixing of red and green light, produce shades of yellow or orange. Mixing green and blue produces shades of cyan, and mixing red and blue produces shades of purple and magenta. Mixing equal proportions of the additive primaries results in shades of grey; **when all three colors are fully saturated, the result is white**. The color space that is generated is called the RGB ("red, green, blue") color space.

Subtractive primaries
Media that use reflected light to produce colors are using the subtractive color method of color mixing. In the printing industry, to produce the varying colors, apply the subtractive primaries yellow, cyan, and magenta together in varying amounts. Subtractive color works best when the surface or paper, is white, or close to it.

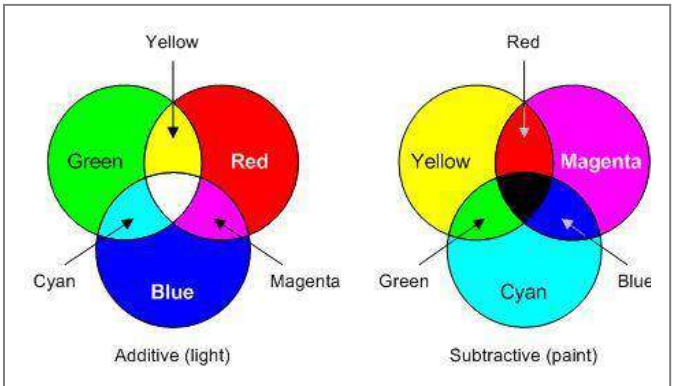


Figure: Additive & subtractive color combinations.

Mixing yellow and cyan produces shades of green; mixing yellow with magenta produces shades of red, and mixing magenta with cyan produces shades of blue. In theory, mixing equal amounts of all three pigments should produce shades of grey, resulting in black when all three are fully saturated, but in practice they tend to produce muddy brown colors. For this reason, a fourth "primary" pigment, black, is often used in addition to the cyan, magenta, and yellow colors.

The color space generated is the so-called CMYK color space. The abbreviation stands for "Cyan, Magenta, Yellow, and Black" — K stands for "Kohle" (German for coal) and is used to represent black as 'B' could be confused with 'Blue'.
In practice, mixtures of actual materials like paint tend to be less precise. Brighter, or more specific colors can be created using natural pigments instead of mixing, and natural properties of pigments can interfere with the mixing. For example, mixing magenta and green in acrylic creates a dark cyan - something which would not happen if the mixing process were perfectly subtractive. In the subtractive model, adding white to a color does not (in theory) change its hue but does reduce its saturation. In fact, adding

Qatar National Conventional Center by **Arata Isozaki**

4×4 House II by Tadao Ando

Toyota Stadium by *Kisho Kurokawa*

World Trade Center, New York by **Minoru Yamasaki**

Tadao Ando

Nakagin Capsule Tower

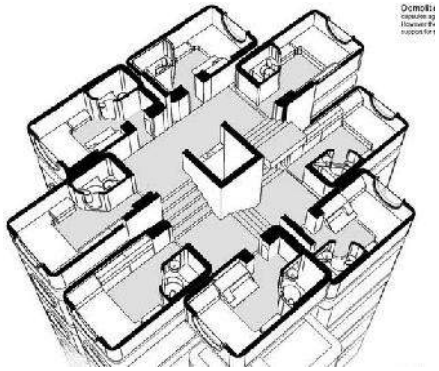


Figure: Nakagin Capsule Tower. The room.

Figure: Nakagin Capsule Tower. The room.

Q.41 Proportioning system used in the layout of Mughal Gardens is derived from
(A) Rational number system
(B) Constants of equilateral triangle
(C) Irrational number system
(D) Constants of right angled isosceles triangle

Q.42 Global climate change is expected to bring about a combination of the following changes. Identify the correct combination.
P. Increase in Biodiversity
Q. Emergence of New Diseases
R. Loss of Biodiversity
S. Loss of all Rocky Outcrops
T. Sea Level Rise
U. Extinction of Polar Bears
V. Emergence of New Islands

(A) P, Q, R, S (B) Q, R, T, U (C) R, T, U, V (D) Q, R, U, V

Q.43 Annual housing demand of a metropolitan city is estimated through the combination of the
following components. Identify the correct combination.
P. New Entrants to the City
Q. Elderly Population Living in Cities
R. New Relocated Slum Dwellers
S. Slum Squatter Dwellers
T. Unauthorized Dwelling Units
U. Dilapidated Houses
V. Pan of Backlog
W. Any Other Houses

(A) P,R,T (B) U, S, Q (C)W,Q,T (D) P, U, V

Figure: Nakagin Capsule Tower.

Q.44 Match the visionaries in Group I with their concepts in Group II

Group I	Group II
P. Clarence A. Perry	1. Post Modernism
Q. Constantinos Doxiadis	2. Bauhaus
R. Paul Davidoff	3. Advocacy Planning
S. Walter Gropius	4. Dynopolis
	5. Neighborhood Unit

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

Notes: **Clarence A Perry** (1872 1944) was an American planner, sociologist, author, and educator. He was born in New York. He later worked in the New York City planning department where he became a strong advocate of the Neighborhood unit. He was an early promoter of neighborhood community and recreation centers.

The **neighbourhood unit** was conceived of as a comprehensive physical planning tool, to be utilised for designing self-contained residential neighbourhoods which promoted a community centric lifestyle, away from the "noise of the trains, and out of sight of the smoke and ugliness of industrial plants" emblematic of an industrialising New York City in the early 1900s.

The core principles of Perry's Neighbourhood Unit were organised around several physical design ideals:

"**Centre the school** in the neighbourhood so that a child's walk to school was only about one-quarter of a mile and no more than one half mile and could be achieved without crossing a major arterial street. Size the neighbourhood to sufficiently support a school, between 5,000 to 9,000 residents, approximately 160 acres at a density of ten units per acre. Implement a wider use of the school facilities for neighbourhood meetings and activities, constructing a large play area around the building for use by the entire community.

Place arterial streets along the perimeter so that they define and distinguish the "place" of the neighborhood and by design eliminate unwanted through-traffic from the neighborhood. In this way, major arterials define the neighborhood, rather than divide it through its heart.

(A) the land area required to preserve as forests to ensure sufficient levels of oxygen for a community.
(B) the land area necessary to supply natural resources to a community and disposal of its wastes.
(C) the land area required to take care of solid wastes and sewerage of a community.
(D) the land area per person per year, from which forests are cut.

Q80. Match the following with their area of application.

P.	Potometer	1.	Area measurement
Q.	Histogram	2.	Soil moisture measurement
R.	Electrostatic precipitator	3.	Transpiration
S.	Planimeter	4.	Suspended particles
T.	Potentiometer	5.	Statistics

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

Q81. Select the appropriate word from the list given below the fits in ALL the blanks:
1. The aim of conservation is to retain or recover the _____ significance of a place.
2. Preservation is appropriate where the existing state of the fabric itself constitutes of specific _____ significance.
3. Restoration is appropriate only if there is sufficient evidence of an earlier state of the fabric and only if returning the fabric to that state recovers the _____ significance of the place.
4. Reconstruction is appropriate where a place is incomplete through damage or alternation and where it is necessary for its survival, or where it recovers the _____ significance of the place as a whole.

(A) historical (B) cultural (C) architectural (D) aesthetic

Q82. Two names associated with the planning of Paris and Philadelphia are respectively:
(A) Georges-Eugene Hausmann and William Penn
(B) Patrick Geddess and Louis Wirth
(C) Albert Perry and Oswald Spangler
(D) Le Corbusier and John Friedman

Q83. Which of the following statements is valid for a saddle surfaced shell structure?
P. regions of downward curvature exhibit arch like action
R. regions of upward curvature behave as a cable structure

(A) P is true and R is false
(B) R is true and P is false
(C) Both P and R are true
(D) Both P and R are false

Q84. Which of the following statements describes the advantage of A.C. supply over D.C. supply?
(A) Electroplating process
(B) Noise reduction in motors
(C) Facility of transforming from one voltage to another
(D) Charging of storage batteries

Q85. For which application software the following expression is valid?
(*2.5 (+(/ a 2) (- 5 ´)))
(A) Qbasic (B) AutoLISP (C) Java (D) C++

END OF THE QUESTION PAPER 2008

GATE 2007

Numerical Q&A:

1. Hazen's-William's nomogram is used to calculate
(A) size of sanitary pipe lines (B) size of water supply pipe lines
(C) capacity of overhead water reservoir (D) capacity of water required for fire fighting

Answer (B) The **Hazen–Williams equation** relates the flow of water in a pipe with the physical properties of the pipe and the pressure drop caused by friction.

$$V = k\,C\,R^{0.63}\,S^{0.54}$$

where:

V is velocity
k is a conversion factor for the unit system (k = 1.318 for US customary units, k = 0.849 for SI units)
C is a roughness coefficient
R is the hydraulic radius
S is the slope of the energy line (head loss per length of pipe or h_f/L)

Manning's Equation

One the most commonly used equations governing Open Channel Flow is known as the Mannings's Equation. The Mannings equation is an empirical equation that applies to uniform flow in open channels and is a function of the channel velocity, flow area and channel slope.

$$Q = VA = \left(\frac{1.00}{n}\right) AR^{\frac{2}{3}}\sqrt{S} \quad [SI]$$

Where:
Q = Flow Rate, (ft^3/s)
V = Velocity, (ft/s)
A = Flow Area, (ft^2)
n = Manning's Roughness Coefficient
R = Hydraulic Radius, (ft)
S = Channel Slope, (ft/ft)

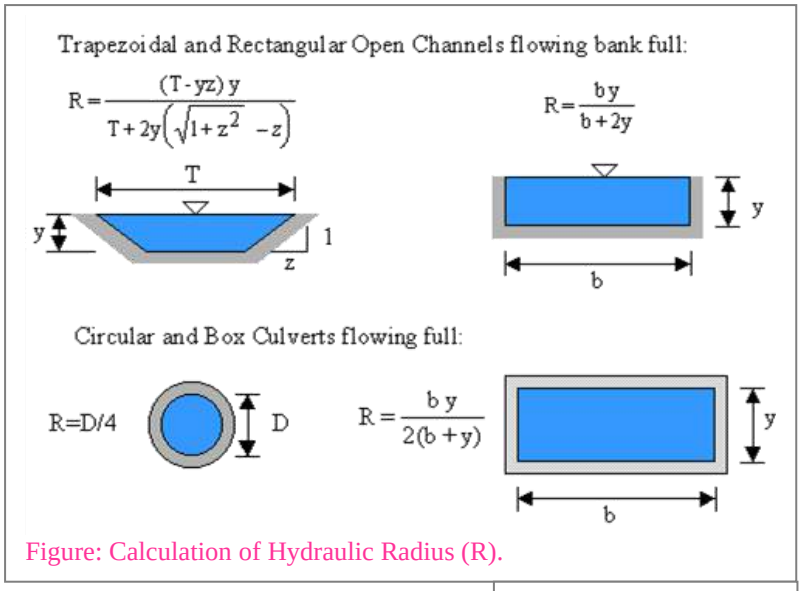


Figure: Calculation of Hydraulic Radius (R).

Under the assumption of uniform flow conditions the bottom slope is the same as the slope of the energy grade line and the water surface slope. The Manning's n is a coefficient which represents the roughness or friction applied to the flow by the channel. Manning's n-values are often selected from tables, but can be back calculated from field measurements. In many flow conditions the selection of a Manning's roughness coefficient can greatly affect computational results.

2. The degree of freedom of a joint in a plane truss is (A) two (B) three (C) four (D) six

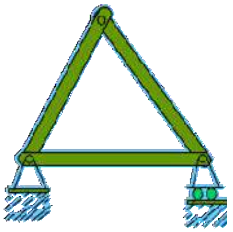


Figure: A simple triangular truss.

Notes: The illustration shows most basic triangular truss. Members are connected by pin-joints, which arrest translation but not rotation. Each member has three degrees of freedom in a plane, two translations and one rotation. Total degrees of freedom are 9. Each pin joint arrests two degree of freedom. Hence, degrees of freedom of pin-joint connected structure is 3. For keeping the structure stationary, these three degrees of freedom should be arrested. In the figure, left fixed support arrests two degrees of freedom, whereas in the right, the roller support arrests one degree of freedom. Thus the structure cannot move and the structure is called stable. This type of structure is also called rigid structure. Answer (B)

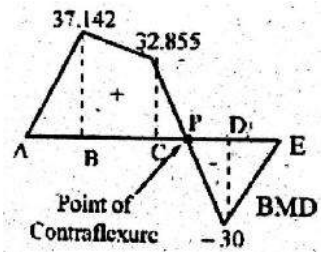


Figure: **Point of contraflexure** is point in BMD where it changes its sign from negative to positive or vice versa.

3. The point of contraflexure is the point where the
(A) shear force changes its sign (B) deflection is zero
(C) bending moment changes its sign (D) torque is zero

Solution: In a bending beam, a **point** is known as a **point of contraflexure** if it is a location at which no bending occurs. In a bending moment diagram, it is the **point** at which the bending moment curve intersects with the zero line. In other words where the bending moment changes its sign from negative to positive or vice versa. Answer (C)

4. When wind loads are accounted for in the design of structures, the permissible stresses in the material are increased by (A) 10% (B) 16.33% (C) 33.33% (D) 50%

Notes: IS 800 is applicable. Sub-section is 3.9.2.1
3.9.2.1 Wind or earthquake loads:
Structural steel and steel castings - When the effect of wind or earthquake load is taken into account, the permissible stresses specified may be exceeded by 33.33 percent. Answer (C)
(Source: https://www.sefindia.org/forum/viewtopic.php?t=5475)

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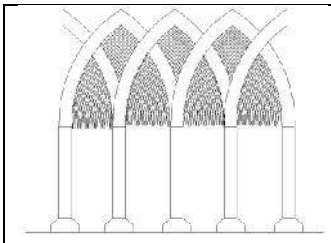
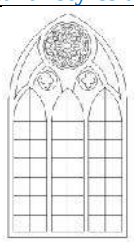
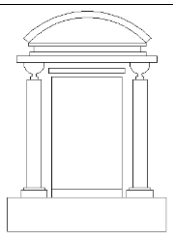
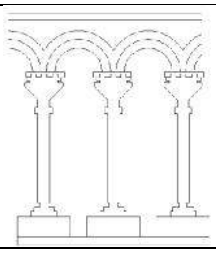
Q76. Match the correct names of the **architectural styles** and **periods**.

			
P	Q	R	S
1	2	3	4
Moorish Style 15th Century	Romanesque Style 11th – 12th Century	Gothic Style 13th – 14th Century	Renaissance Style 15th – 16th 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

Q78. The figures 1 and 2 represent two different cases of buildings forms, building layouts and site features on sites located respectively in hot-humid and hot-dry regions. Considering the factors listed below which of the following options compared best the relative pressure and absence of these factors in the two cases.

Factors:
V- Cross Ventilation
P- Privacy in outdoor space
E- Exposure to outside view

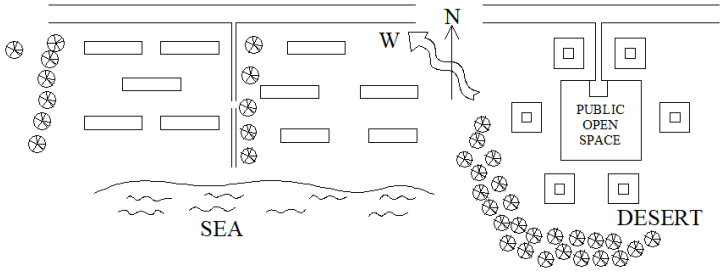
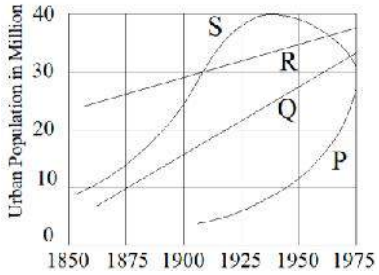


Figure 1 Figure 2

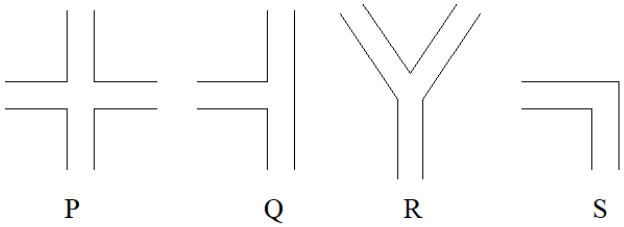
(A) Figure 1 has more V, more P and better E than Figure 2
(B) Figure 2 has less V, more P and better E than Figure 1
(C) Figure 2 has more V, more P and less E than Figure 1
(D) Figure 1 has more V, less P and better E than Figure 2

Q79. The graph be;ow shows urban population growths of four countries (P, Q, R and S) with time.
Which of the following statements is INCORRECT?



(A) Urbanisation started much later in 'P' than in 'S' and it has achieved lower growth rate.
(B) Growth rate is higher in 'Q' than in 'R'
(C)Growth rate has been higher in 'P' than in 'Q', 'R', 'S' after 1900
(D) Urban population is higher in 'R' than in 'Q'

Q80. The following figures show four different unmanaged traffic intersections in a city.
Which of the following statements shows the correct numbers of **potential traffic conflict points** (excluding merging points) at the intersections?
(A) P-8, Q-3, R-3, S-2
(B) P-16, Q-3, R-3, S-0
(C) P-8, Q-3, R-3, S-0
(D) P-16, Q-3, R-3, S2x



Q81. Arrange the sequence of events in a Residential site development
P. Levelling and land filling
Q. Trees and plantation
R. Electrification
S. Allotment
T. Provision of roads
U. Provision of water supply, sewerage and drainage
(A) R, S, T, U, P, Q
(B) P, R, S, U, T, Q
(C) Q, P, S, R, T, U
(D) P, T, Q, U, R, S

Less Is More vs Less Is A Bore		
	Less Is More	**Less Is A Bore**
Definition	A rule of thumb for minimalism in art and architecture.	A rule of thumb for postmodern architecture that embraces expressive form and ornamentation.
Attributed To	Ludwig Mies van der Rohe	Robert Venturi
Associated With	Modernism Minimalism	Postmodern architecture

1.8 Turbidity of water is due to

(A) Algae (B) Fungi

(C) Orange salt **(D) Suspended matters**

Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. *Turbidity* is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air.

1.9 The only architect-president of a nation was

(A) Richard Nixon (B) F. Marcos (C) **Thomas Jefferson** (D) L. B. Johnson

Figure: **Thomas Jefferson** was the third President of the United States. He was the first President to be inaugurated in Washington DC, a city that he helped plan. The foremost spokesperson for Democracy of his time, he was the author of the Declaration of Independence.

(Source: http://www.sheppardsoftware.com/History/presidents/Presidents_3_Jefferson.htm)

1.10 Intensity of color refers to

(A) **brightness** (B) darkness (C) pigment density (D) quantity

Notes: Value vs. Intensity

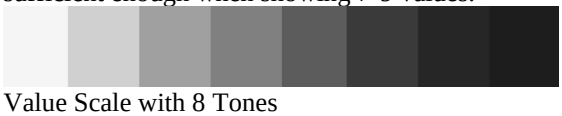
The words, "value" and "intensity" are thrown around quite a bit in the world of art-making. And although their definitions are quite different, they are often confused with each other.

While value and intensity are different, they do have somewhat overlapping applications. This is one of the reasons that they are so often confused. Even though their applications are sometimes used interchangeably, knowing the difference between the two can help us make better aesthetic decisions in our drawings and paintings.

What is Value?

Let's start by discussing value. Value, in terms of art, is the darkness or lightness of a color. Value is one of the seven elements of art and in many circles, it is considered to be the most important. Its importance in creating the illusion of light, form, and texture in a drawing or painting cannot be denied.

All values can be measured using a value scale, which theoretically has an infinite number of values. Most value scales are sufficient enough when showing 7-9 values.



Value Scale with 8 Tones

All colors have an inherent value associated with them. For example, purely pigmented yellows are generally lighter in value when compared to purely pigmented blues, which are darker.

b) A flat area is photographed in a scale of 1:10,000 with a camera of 15 cm focal length. The bottom of a chimney stack is found to lie at a distance of 12.01 cm from the principle point of the photograph and the top at a distance of 12.22 cm. Find the height of the chimney stack.

Answer: Illustration of deformation of an **aerial** image according to the distance from the nadir point, i.e. the centre of the image. A vertical object (such as a building, for instance) will appear to be lying along a line radial to the image nadir point. This deformation is called **relief displacement**.
The image nadir point is the point located on the surface exactly below the perspective center.
This relief displacement underlie the following principles:

- Objects will tend to lean outward, i.e. be radially displaced.
- The taller the object, the greater the relief displacement.
- The further the object is from the principal point, the greater is the radial displacement.

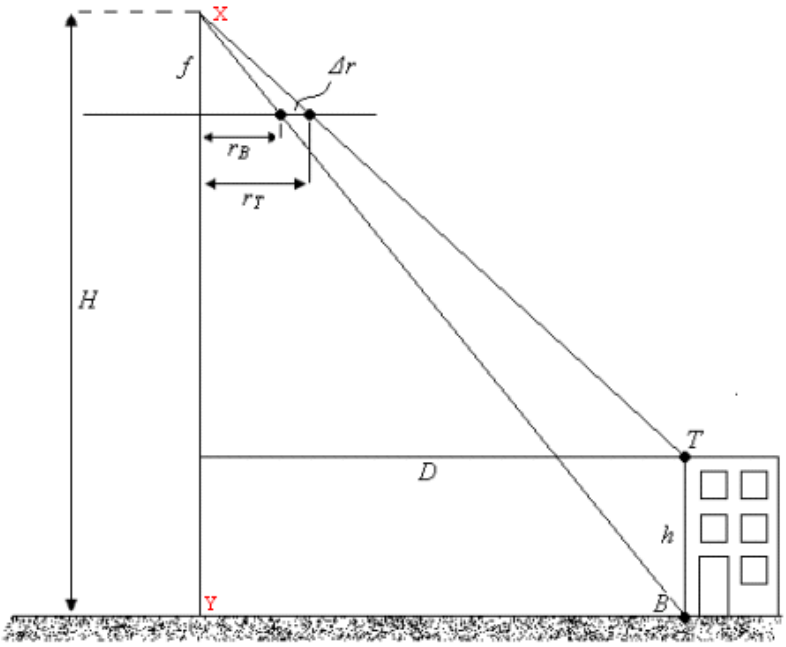


Figure: X is the perspective center, Y is the image nadir point

Relief Displacement: Calculating Height
We can derive an expression for the relationship between object height and relief displacement using the geometry depicted in following picture.
We may write two expressions for distance D in this figure, in terms of radial image distances rB and rT.

$$\frac{r_B}{D} = \frac{f}{H} \quad , \quad D = \frac{H\, r_B}{f}$$

And

$$\frac{r_T}{D} = \frac{f}{H-h} \quad , \quad D = \frac{r_T\,(H-h)}{f}$$

and set the two expressions for D equal to each other,

$$D = \frac{H\, r_B}{f} = \frac{r_T\,(H-h)}{f}$$

$$H\, r_T - h\, r_T - H\, r_B = 0$$

$$H(r_T - r_B) = h\, r_T$$

$$\frac{H\Delta r}{r_T} = h$$

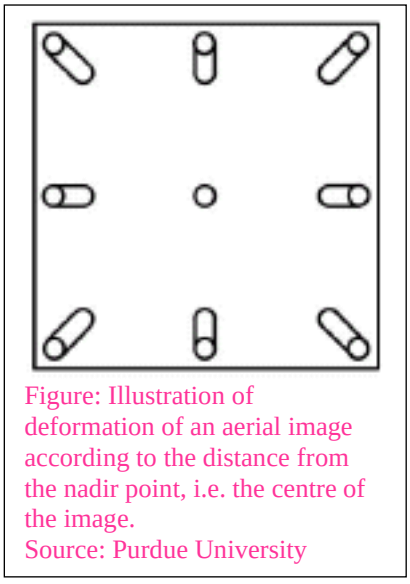
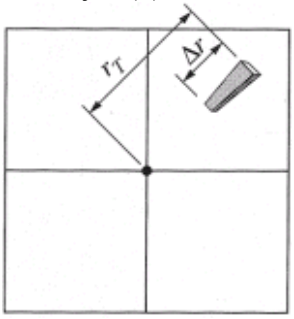


Figure: Illustration of deformation of an aerial image according to the distance from the nadir point, i.e. the centre of the image.
Source: Purdue University

The last equation tells us that the flying height above the base of the object (H) times the relief displacement in the photograph (Δr) divided by the radial distance from the principal point to the top of the object (rT) is equal to the height of the object (h).

Hence, if we know the flying height, we can calculate the height of any object in a photograph!
The height of an object can be estimated from a single aerial photograph provided we have one auxiliary piece of information, the flying height.



Example: The flying height above the base of the building shown in the following figure is 500 m for a vertical photograph H. When measuring the image, the relief displacement of the building (Δr) is 4 mm and the radial distance from the principal point to the top of the object (rT) is 75 mm. What is the height of the building?

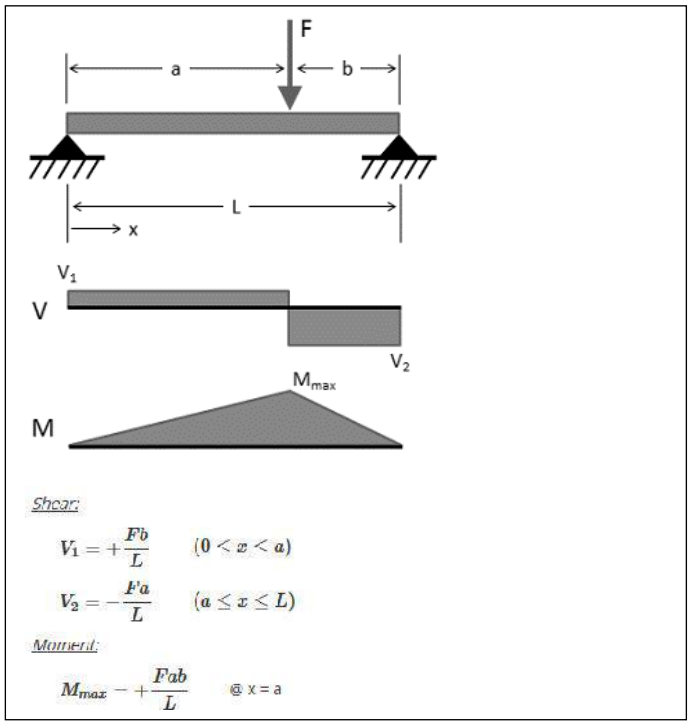
Solution:

$$\frac{H\Delta r}{r_T} = h$$

$$500\ \text{m}\ \frac{4\ \text{mm}}{75\ \text{mm}} = 26{,}7\ \text{m}$$

The building is in reality 26.7 m high.
(Source: http://www.seos-project.eu/modules/3d-models/3d-models-c02-p02-s01.html)

Solution:



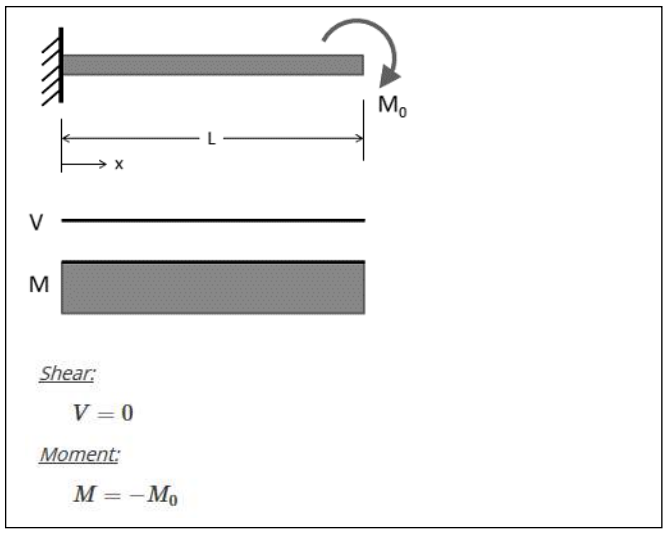
Shear:

$$V_1 = +\frac{Fb}{L} \qquad (0 < x < a)$$

$$V_2 = -\frac{Fa}{L} \qquad (a \le x \le L)$$

Moment:

$$M_{max} = +\frac{Fab}{L} \qquad @\ x = a$$



Shear:

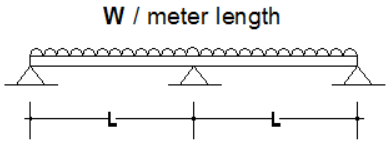
$$V = 0$$

Moment:

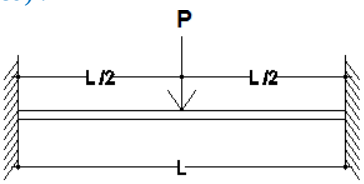
$$M = -M_0$$

Q11.2 Sketch the bending moment and shear force diagram (values not required) :

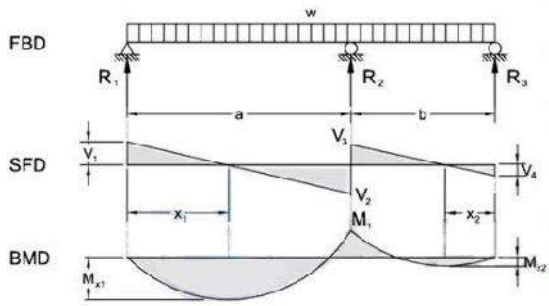
(i)



(ii)



Solution:



$$R_1 = V_1 \ldots\ldots = \frac{M_1}{a} + \frac{wa}{2}$$

$$R_2 \ldots\ldots = wa + wb - R_1 - R_3$$

$$R_3 = V_4 \ldots\ldots = \frac{M_1}{b} + \frac{wb}{2}$$

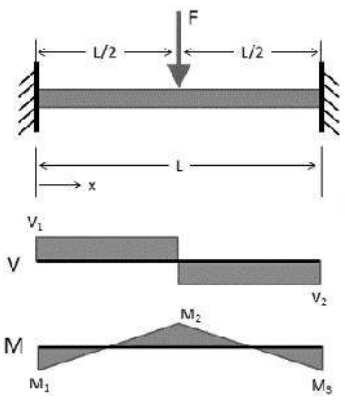
$$V_2 \ldots\ldots = wa - R_1$$

$$V_3 \ldots\ldots = wb - R_3$$

$$M_1 \ldots\ldots = -\frac{wb^3 + wa^3}{8(a+b)}$$

$$M_{x_1}\left(x_1 = \frac{R_1}{w}\right) \ldots\ldots = R_1 x_1 - \frac{wx_1^2}{2}$$

$$M_{x_2}\left(x_2 = \frac{R_3}{w}\right) \ldots\ldots = R_3 x_2 - \frac{wx_2^2}{2}$$



Shear:

$$V_1 = +\frac{F}{2} \qquad (0 \le x \le L/2)$$

$$V_2 = -\frac{F}{2} \qquad (L/2 \le x \le L)$$

Moment:

$$M = \frac{F}{8}(4x - L)^2 \qquad (0 \le x \le L/2)$$

$$M_1 = M_3 = -\frac{FL}{8} \qquad @\ x = 0 \text{ and } x = L$$

$$M_2 = +\frac{FL}{8} \qquad @\ x = L/2$$

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