GATE
QUESTION BANK BLACK & WHITE

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

BETTER CONTENT AT BEST PRICE

By Faculty of Architecture

GATE *ARCHITECTURE* .com

Volume
①&②

With
**LATEST
UPDATE**

TABLE OF CONTENTS

Note: In pursuit of constantly improving this book, we might delete or add contents without prior information. This is not the exact black & white print version of the color printed question bank that comes in 4 volumes and a total 602 pages. However, this book is substantially sourced from the same color printed question bank. Color print of 8+ pages of illustrations has been included in this book for better understanding of the subject.

SYLLABUS GATE 2022

Architecture and Planning (AR): New Pattern

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

Highlighted texts below are the syllabus part from which questions were asked in GATE AR 2022 and the superscripts are the question numbers.

Part A: General

Section 1: Architecture, Planning and Design

Architectural Graphics[13, 18]; Visual composition in 2D and 3D[40]; Computer application in Architecture and Planning; Anthropometrics; Organization of space; Circulation- horizontal and vertical[30s]; Space Standards; Universal design[16,17]; Building byelaws; Codes and standards;

Section 2: Construction and Management

Project management techniques e.g. PERT, CPM[46] etc. ;Estimation[47, 48] and Specification; Professional practice and ethics[21]; Form and Structure; Principles and design of disaster resistant structures[30q]; Temporary structures for rehabilitation;

Section 3: Environmental Planning and Design

Natural and man-made ecosystem[19, 38]; Ecological principles; Environmental considerations in Planning and design; Environmental pollution- types, causes[44], controls and abatement strategies; Sustainable development[22], goals and strategies; Climate change and built environment; Climate responsive design[20];

Section 4: Urban Design, landscape and Conservation

Historical and modern examples of urban design; Elements of urban built environment[77] –urban form, spaces, structure, pattern, fabric, texture, grain etc.; Concepts and theories of urban design; Principles, tools and techniques of urban design; Public spaces, character, spatial qualities and Sense of Place; Urban design interventions for sustainable development and transportation; Development controls – FAR[69], densities and building byelaws.; Urban renewal and conservation; heritage conservation[33]; historical public spaces and gardens; Landscape design; Site planning[25];

Section 5: Planning process

Salient concepts, theories and principles of urban planning; concepts of cities[32] - Eco-City, Smart City; Concepts and theories by trendsetting planners and designers[34, 35, 74, 75]; Ekistics; Urban sociology[49]; Social, Economic and environmental cost benefit analysis; Methods of non-spatial and spatial data analysis; Development guidelines such as URDPFI[36, 41];

Section 6: Housing

Housing typologies; Concepts, principles and examples of neighbourhood; Residential densities; Affordable Housing[12]; Real estate valuation[72, 80, 81];

Section 7: Services and Infrastructure

Firefighting Systems[30p]; Building Safety and Security systems; Building Management Systems; Water treatment; Water supply and distribution system[27, 30r, 45]; Water harvesting systems; Principles, Planning and Design of storm water drainage system; Sewage disposal methods; Methods of solid waste management **-** collection, transportation and disposal[28]; Recycling and Reuse of solid waste; Land-use – transportation **-** urban form inter-relationships; Design of roads, intersections, grade separators and parking areas[26]; Hierarchy of roads[15] and level of service; Para-transits and other modes of transportation, Pedestrian and slow moving traffic planning;

Part B1: Architecture

Section B1.1: History and Contemporary Architecture

Principles of Art and Architecture; World History of Architecture[39, 43, 51, 53, 57]: Egyptian, Greco-Roman classical period, Byzantine, Gothic, Renaissance, Baroque-Rococo, etc.; Recent trends in Contemporary Architecture: Art nouveau, Art Deco, Eclecticism, International styles, Post Modernism, Deconstruction in architecture, etc.; Influence of Modern art and Design in Architecture; Indian vernacular and traditional Architecture[31, 61], Oriental Architecture; Works of renowned national and international architects[37, 58];

Section B1.2: Building Construction and Structural systems

Building construction techniques, methods and details; Building systems and prefabrication of building elements; Principles of Modular Coordination; Construction planning[29] and equipment[60]; Building material characteristics and applications[50, 54]; Principles of strength of materials[52]; Alternative building materials; Foundations; Design of structural elements with different materials[59]; Elastic and Limit State design; Structural systems[14, 23, 56, 63]; Principles of Pre-stressing; High Rise and Long Span structures, gravity and lateral load resisting systems;

Section B1.3: Building Services and Sustainability
Solar architecture[11, 55, 65]; Thermal[24], visual[62] and acoustic[64] comfort in built environments; Natural and Mechanical ventilation in buildings; Air-Conditioning systems[42]; Sustainable building strategies; Building Performance Simulation and Evaluation; Intelligent Buildings; Water supply; Sewerage and drainage systems; Sanitary fittings and fixtures; Plumbing systems; Principles of internal and external drainage system; Principles of electrification of buildings; Elevators and Escalators - standards and uses;

Part B2: Planning
Section B2.1: Regional and Settlement Planning
Regional delineation; settlement hierarchy; Types and hierarchy of plans; Various schemes and programs of central government; Transit Oriented Development (TOD)[76], SEZ, SRZ etc.; Public Perception and user behaviour; National Housing Policies, Programs and Schemes.; Slums, Squatters and informal housing; Standards for housing and community facilities; Housing for special areas and needs;

Section B2.2: Planning Techniques and Management
Application of G.I.S and Remote Sensing techniques in urban and regional planning; Tools and techniques of Surveys – Physical, Topographical, Land use and Socio-economic Surveys; Urban Economics[67], Law of demand and supply of land and its use in planning; Graphic presentation of spatial data; Local self-governance, Panchayati Raj institutions; Planning Legislation and implementation – Land Acquisition Act, PPP[70] etc.; Decision support system and Land Information System; Urban geography and econometrics; Management of Infrastructure Projects; Demography and equity in planning;

Section B2.3: Infrastructure Planning
Process and Principles of Transportation Planning and Traffic Engineering[68]; Road capacity and Travel demand forecasting; Traffic survey methods, Traffic flow Analysis[71, 79]; Traffic analyses[73] and design considerations; Traffic and transport management and control in urban areas[66, 78]; Mass transportation planning; Intelligent Transportation Systems; Urban and Rural Infrastructure System Network.

General Aptitude (15 marks)
Verbal Aptitude
Basic English grammar[1]: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech
Basic vocabulary: words, idioms, and phrases in context Reading and comprehension[6] Narrative sequencing

Quantitative Aptitude
Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional plots, maps, and tables Numerical computation[7] and estimation: ratios[8], percentages[2,3], powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability

Analytical Aptitude
Logic[10]: deduction and induction, Analogy, Numerical relations and reasoning[4,9]

Spatial Aptitude
Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping Paper folding, cutting, and patterns in 2 and 3 dimensions[5]
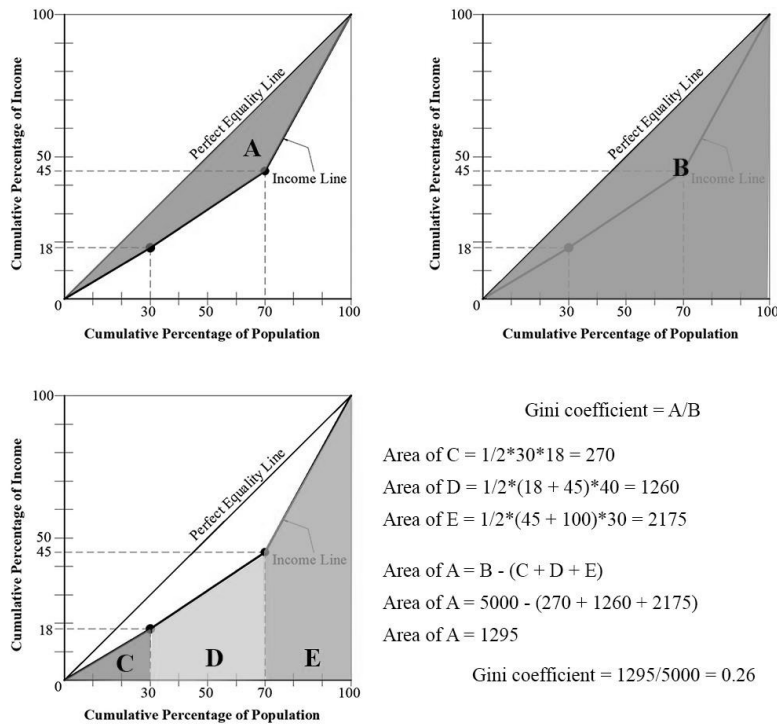
Q.48 The reflected ceiling plan and section of a reinforced cement concrete roof are shown in the following Figure. All the beams are 300 mm wide, 600 mm deep (including 150 mm slab) equidistantly placed center to center. Assuming 1% of concrete volume is occupied by reinforcement bars, the volume of concrete (in cubic meters, rounded off to two decimal places) is _____.
(2 marks)
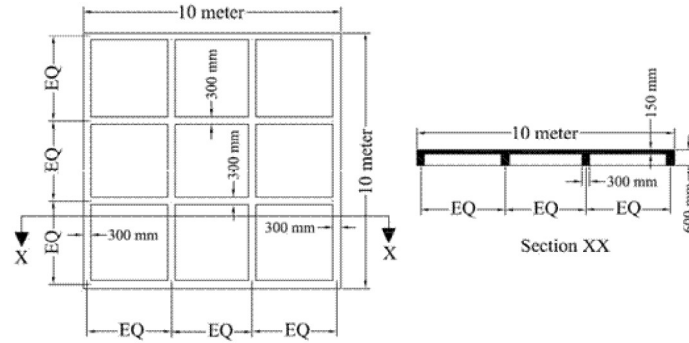
Solution: Volume without 9 depressions = 10 m x 10 m x 0.6 = 60 m^3
Length of side of a BIG square (adding all 9 small squares) = 10 m – 4 x 0.3 = 8.8 m
Volume of 9 depressions (BIG square) = 8.8 m x 8.8 m x 0.45 m = 34.85 m^3
So, Volume of reinforced concrete roof = 60 – 34.85 = 25.15 m^3
99% of 25.15 m^3 = 24.90 Answer

Q.49 The following graph represents the income distribution among the population of a country. The *Gini Coefficient* of the country (rounded off to three decimal places) is …………... (2 marks)
Solution:

Gini coefficient = A/B

Area of C = 1/2*30*18 = 270
Area of D = 1/2*(18 + 45)*40 = 1260
Area of E = 1/2*(45 + 100)*30 = 2175

Area of A = B - (C + D + E)
Area of A = 5000 - (270 + 1260 + 2175)
Area of A = 1295

Gini coefficient = 1295/5000 = 0.26

Part B1 Architectural Section: Optional (Attempt either B1 or B2)

Q.50(B1) Which of the following processes is used for surface treatment of metals?
(A) Soldering (B) Thermoplating ✔ (C) Extrusion (D) Riveting

Thermoplating is the process in which the object or the metal to be coated is heated first and then a coating of another molten metal is applied on it. In this process heat is used for coating. Example: 'Tinning' of brass utensils is a thermoplating process in which the utensils are heated first, and then a coating of molten tin is applied.
Electroplating is the process where; electric current is used to plate the object or metal.

Q.51(B1) Among the following monuments of ancient Greece, the only Octastyle Peripteral temple with eight towering Doric columns lining both east and west facades is _____.
(A) Temple of Athena (B) Temple of Apollo (C) The Parthenon ✔ (D) Temple of Horus

Octastyle temple: It is an adjective in architecture having eight columns in the front, as a temple or portico.
Octastyle peripteral temple with hexastyle portico: A method of designating or distinguishing the temples is by the number of columns in front, thus temples are called tetrastyle, hexastyle, octastyle, that is having five, six, or eight columns. It was peripteral, octastyle; that is, surrounded by a portico of columns, with eight to each façade.

Q.58(B1) Match the architectural projects in *Group I* with their corresponding architects in *Group II*.

Group I	*Group II*	*Options*
(P) Indian Institute of Management Bangalore (Q) Osho International Meditation Resort, Pune (R) Nalanda International School, Vadodara (S) Matrimandir, Auroville	(1) Revathi Kamath (2) Brinda Somaya (3) Roger Anger (4) B. V. Doshi (5) Hafeez Contractor	(A) P-4, Q-5, R-2, S-3 ✔ (B) P-4, Q-1, R-5, S-2 (C) P-2, Q-4, R-5, S-1 (D) P-3, Q-5, R-1, S-2

Most repeated option:	P-4 Q-5 R-5 S-2
Probable answer:	None. '5' repeated two times.
Predicted answer was:	Unable to predict

Revathi S. Kamath is a pioneer of mud architecture in India. On the other hand, she is also credited with building the tallest stainless steel structure in India. She is noted for her sensitive efforts for conceiving the "Evolving Home" concept for redevelopment. Three of her projects have been nominated for the Aga Khan Award. She has contributed to the exhibition – "Traditional Architecture in India" for the festival of India in Paris, in 1986. She was also on the contributing design team for the Eternal Gandhi Multimedia Museum. She was co-curator and designer for the exhibition "Craft: A Tool for Social Change" for Voluntary Health Association of India in 2003. Her current field of interest is Indigenous architecture.

Architect Revathi S. Kamath	Tribal Museum, Bhopal	Tal Chappar, Churu, Rajasthan	Residence of Ar. Revathi S. Kamath
Joseph's Cathedral, Imphal, Manipur	Akshay Pratishthan, Delhi	Laxman Sagar Resort, Pali	JSPL Gateway in Raigarh, Chhattisgarh, India.

Brinda Somaya is an architect and an urban conservationist. Upon completion of her Bachelor of Architecture from Mumbai University and her Master of Arts from Smith College in Northampton, MA, U.S.A. She started her firm Somaya and Kalappa Consultants (SNK) in 1978 in Mumbai, India. In 2014 she was awarded the Indian Institute of Architects – Baburao Mhatre Gold Medal for Lifetime Achievement and was also nominated for the arcVision Prize. In 2016 she was appointed as the Chairperson of the Board of Governors, School of Planning and Architecture, Vijayawada – an Institute of National Importance. In 2017 she joined the Board of the Lafargeholcim Foundation for Sustainable Construction, Zurich, Switzerland. Presently she is the A.D. White Professor-at-large at Cornell University, U.S.A.

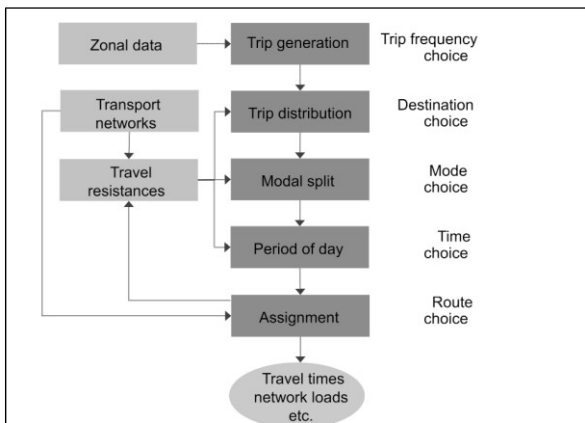|			
Architect Brinda Somaya	Goa Institute of Management, 2011	The Vikram Sarabhai Library Building in IIM, Ahmedabad	The Nalanda International School, Vadodara
Tata Consultancy Services Campus, Indore	Facade of the Bombay House	Club Mahindra Kumbhalgarh Resort, Rajasthan	Rajabai Clock Tower, Mumbai 2013-2015

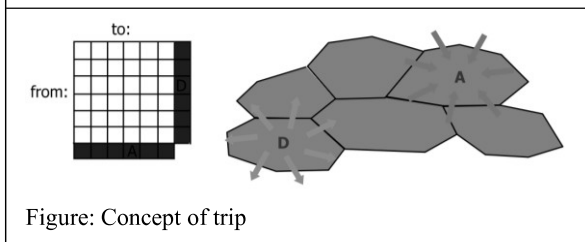Figure: The trip generation in transportation modelling

Figure: Concept of trip

Example of liner regression in a trip generation model:

$$Y = 0.91 + 1.44X_1 + 1.07X_2$$

number of trips   number of workers   number of cars

Where,

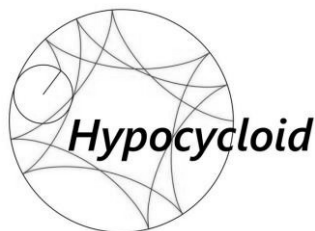Y = No. of trips per household = Independent variable

X_1 = No. of workers per household = Dependent variable

X_2 = No. of cars per household = Dependent variable

(Source: https://ocw.tudelft.nl/wp-content/uploads/2.1-Trip-generation-1.pdf
https://www.analyticsvidhya.com/blog/2015/08/comprehensive-guide-regression/)

Figure: Example of linear regression. It is finding of the formula of the line (here in **red**) that would reparent the best relationship between the variables. The regression line will demonstrate the relationship between the independent variable (rainfall) and dependent variable (umbrella sales)

Figure: Example of tour

Q.15 The curve traced by a point on a circle rolling inside another circle is known as

(A) hypocycloid ✔ (B) helix (C) involute (D) hyperbola

(Source: https://mathimages.swarthmore.edu/index.php/Involute)

Figure: Helix, Involute and Hyperbola respectively

Q.16 The law of Primate City was first proposed by

(A) Samuel A. Stouffer   (B) Colin Clark

(C) Mark Jefferson ✔   (D) Harold Hotelling

The idea of primacy was first introduced by Mark Jefferson in 1939. His proposition was that nationalism crystallizes in primate cities, which are super eminent in both size and national influence. He assessed the degree of primacy by computing the ratio of the size of the second and third ranking cities to that of the largest one. He found that in the forty-six countries of the world, the largest cities were two or three times as large as the next largest city. The ratio of the population of the three largest cities approximated the sequence 100:30:20 (i.e. the third largest is one-fifth the six of the largest). According to him, there are various reasons for a city to exceed its neighbors in size, but once it did so, the process became cumulative, giving it an impetus to grow and draw away from all other

Figure: "A primate city as being at least twice as large to the next largest city, and more than twice as significant."
~ Mark Jefferson

cities in character as well as size. The particular ratio sequence has been later ignored, though the concept of the primate city and primacy is widely used.

A primate city is the largest city in its country or region, disproportionately larger than any other in the urban hierarchy. A primate city distribution is a rank-size distribution that has one very large city with many much smaller cities and towns, and no
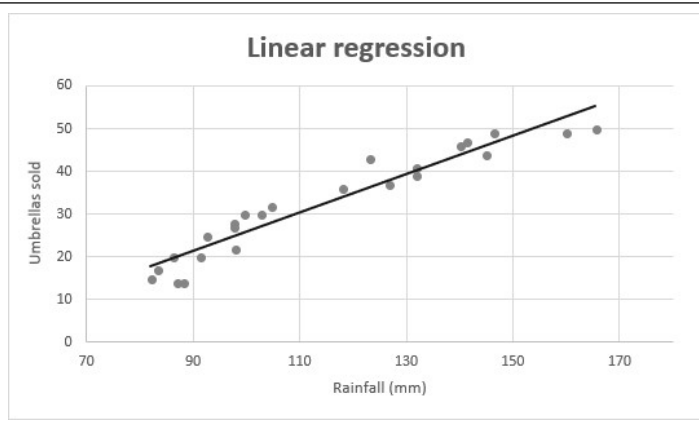
Q.18 An urban governance tool to mobilize financial resources by permitting additional FAR over and above the prescribed FAR by imposing a charge or fee for the same is known as
(A) Betterment Levy (B) Impact Fee (C) Land Value Increment Tax (D) Floor Area Incentive Tax
(Marks to all) Most appropriate answer is option (C).

Q.19 Identify the colour palette that is created using any three equally spaced hues around the colour wheel.
(A) Split – complementary (B) Analogous (C) Triads ✔ (D) Complementary

Q.20 Coefficient of Performance (COP) for heat pump is used to calculate
(A) the number of air changes.   (B) the Energy Efficiency Ratio ✔
(C) the Energy Select Sector index.   (D) the Indoor Air Quality index.

$$COP = \frac{\text{energy out}}{\text{energy in}}$$

Energy out, or the heat pump's expected output
Energy in, or how much energy it takes to run the heat pump

The efficiency of refrigeration systems and heat pumps is denoted by its Coefficient Of Performance (COP). The COP is determined by the ratio between energy usage of the compressor and the amount of useful cooling at the evaporator (for a refrigeration installation) or useful heat extracted from the condenser (for a heat pump). A high COP value represents a high efficiency.

Most of the electric energy needed to drive the compressor is released to the refrigerant as heat. Therefore, more heat is available at the condenser than is extracted at the evaporator of the heat pump. (Source: https://industrialheatpumps.nl/en/how_it_works/cop_heat_pump/)

Q.21 Freight flows are converted to truck flows using
(A) Volume factor   (B) Weight factor
(C) Payload factor ✔   (D) Distance load factor

Q.22 Rebound hammer test is used to measure
(A) permeability of concrete
(B) bond stress between rebar and concrete
(C) compressive strength of concrete ✔
(D) tensile strength of concrete

Scan to watch on Youtube about the Rebound hammer test.

Q.23 During earthquake, soft storey failure in a building is due to
(A) shear failure initiated by short column effect.
(B) stress discontinuity initiated by abrupt changes of stiffness. ✔
(C) failure of column initiated by weak column – strong beam effect.
(D) drift of building storey initiated by pounding effect.

Q.24 Which type of temporary supporting structure can be used in case of rebuilding the lower part of a load bearing wall at ground floor above plinth level?
(A) Dead Shore   (B) Pit Underpinning
(C) Flying Shore   (D) Needle Scaffolding

Shoring is the technique of using a temporary support, usually a form of prop, to make a structure stable and safe.
It is often used to provide lateral support:
- To walls undergoing repair or reinforcement.
- During excavations.
- To prevent walls bulging out.
- When an adjacent structure is to be pulled down.
- When openings in a wall are made or enlarged.

There are three basic types of **shoring** system that can be used separately or in combination, depending on the nature of the support required.

Figure: Raking shore
(Source: civilconcept.com)

Raking shores involve inclined members, or rakers, typically placed at 3-4.5 m centres, and braced at regular intervals. They tend to be inclined at between 40-75°. Typical materials that are used include timber, structural steel, and framed tubular scaffolding.

Dead shores are primarily used to carry vertical loadings from walls, roofs and floors. This is often required when an opening is being made in a wall, or a defective loadbearing wall is being rebuilt. An arrangement of beams and posts supports the structural weight and transfers it to the firm ground foundation below.


Figure: Dead or vertical shore
(Source: civilconcept.com)

Solution: Amount to be deposited at the end of 30 years = 400000 − 10% = 360000 = P $*\frac{(1+r)^n-1}{r}$ = P $*\frac{(1+0.05)^{30}-1}{0.05}$

= 400000 $*\frac{1.05^{30}-1}{0.05}$ = P $*$ 66.44

⇨ P = 5418.42 Answer

Q.47 Reading in the staff stationed at P measured by a dumpy level is 3.5 m. The dumpy level is stationed at Q. The Reference Level (RL) at point P is 96.5 m and the height of the dumpy level is 1.25 m. The RL at point Q is …………… m. [round off to 2 decimal places] *Answer: 98.75 to 98.75*

Solution: If we subtract the height of dumpy level i.e. 1.25 m from the reading of dumpy level i.e. 3.5 m, we get the height H that above RL at point P. So, H = 3.5 − 1.25 = 2.25 m
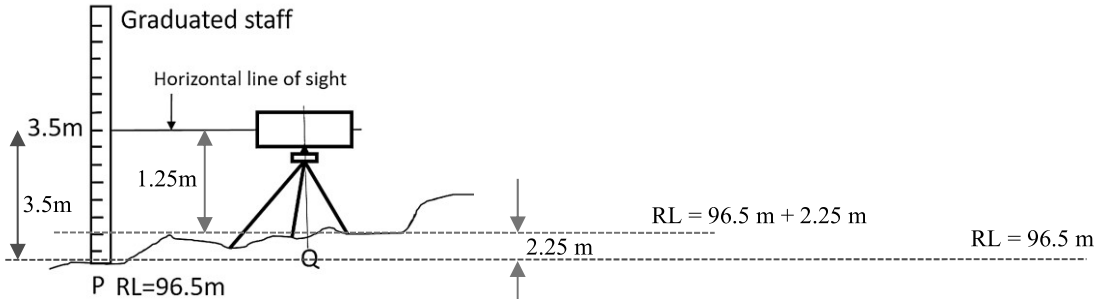
As shown in the figure, point Q is above point P. Therefore, RL at point Q = 96.5 + 2.25 = 98.75 Answer

Q.48 A building is constructed on a plot measuring 70 m × 40 m. The utilized FAR of the building is 1.5. An energy audit team found that the average monthly electricity bill of the building is INR 2,94,000. The unit cost of the electricity is INR 7. The Building Energy Index is _____ kW-hr/m^2 /year. [in integer] *Answer: 120*

Solution: To solve this question, you do not need to know what is Building Energy Index. Just look at the unit of Building Energy Index given in the question itself that is kW-hr/m^2 /year.

To solve this question, you should know that 1 unit of electricity = 1kW-hr

We need to calculate how much units of electricity are consumed in a year.

Annual electricity cost = 12 x INR 2,94,000 = INR 3528000 / year

Units of electricity = $\frac{INR\ 3528000}{INR\ 7}$ = 504000 units / year = 504000 kW-hr / year

Total built-up area = FAR $*$ Plot area = 1.5 $*$ (70 m$*$40 m) = 4200 m^2

Building Energy Index = $\frac{504000\ kW-hr/year}{4200\ m^2}$ = 120 kW-hr/m^2 /year Answer

Q.49 A simply-supported steel beam made of an I-section has a span of 8 m. The beam is carrying a uniformly distributed load of 15 kN/m. The overall depth of the beam is 450 mm. The moment of inertia of the beam section is 18000 cm^4. The maximum bending stress in the beam will be _____ N/mm^2. [in integer] *Answer: 150*

Solution: Bending stress = My / I

Where,

M = Maximum Bending Moment = wl^2/8 = (15 kN/m)$*$(8 m)^2 / 8 = 120 kN-m

y = Distance from neutral axis of the beam = 450 mm / 2 = 225 mm = 0.225 m

I = Moment of inertia = 18000 cm^4 = 18000 (10 mm)^4 = 18000000 mm^4

Therefore, Bending stress = (120 $*$ 1000 N-m $*$ 0.225 m) / 18000000 mm^4

= (120 $*$ 1000 N $*$ 1000 mm $*$ 225 mm) / 18000000 mm^4

= 150 N/mm^2 Answer

Q.50 A circular cricket field of 180 m diameter is illuminated by four floodlight towers. The floodlight towers are equally spaced along the perimeter of the field. The height of the floodlight tower is 48 m. Using 'Inverse Square Law', the illumination level at the center of the field is found as 750 Lux. Each tower is consisting of 50 lamps. The rating of each lamp is 700 Watt. The efficacy of each lamp is ………. Lumen /Watt. [round off to 2 decimal places] *Answer: 117 to 119 or 1483 to 1496*

Solution: It seems, the question needs more data. Question could not be solved for the answer that could fit in the official GATE answer range of 117 to 119 or 1483 to 1496.

The answer range 1483 to 1496 Lumen/Watt is never possible.

The greatest luminous efficacy which can theoretically be achieved is 683 lm/W. However, in practice, this value cannot be reached, since, if this were so, it would mean that 1 Watt of physical radiant power can be converted loss-free into visible light.

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

In addition, the overview shows energy conversion efficiency of the lamps examined. The energy
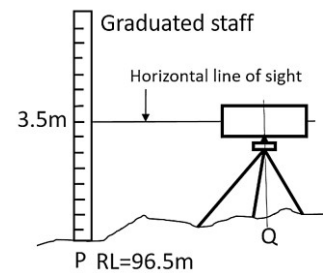
Scan for reading about efficacy of lamps.

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

Q.16 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

Q.17 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 households, 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 rooms required = 3600 x 1 = 3600

Similarly, for three married couple households, 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 rooms required = 432 x 2 = 864

Similarly, for three married couple households, the household with 2 Rooms 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

Q.18 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 _____.
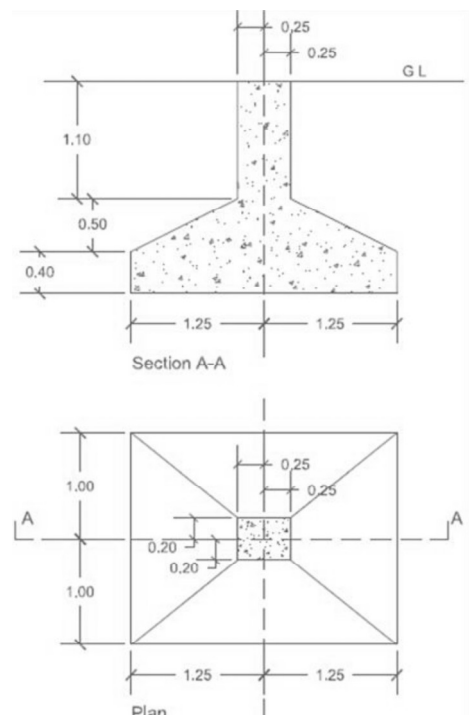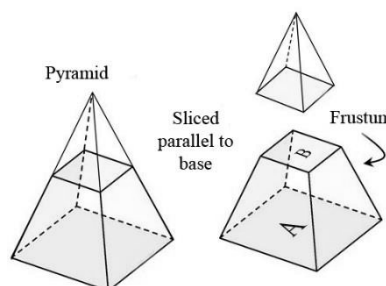
Solution: Let's divide the foundation into 3 parts.
Part I: Rectangular base with height 0.4m
Part II: Slant base with height 0.5m
Part III: Column part with height 1.1m

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 + $\sqrt{5 x 0.2}$) = 1/3*0.5*6.2
= 1.03 m^3
(Official GATE answer range is 3.1 to 3.4)

BS (Blind Guess)					
Options given in the question	**P**	**Q**	**R**	**S**	Analysis
	2	5	4	3	The BS predicts that P should be matched with either 2 or 4, Q should be matched with 5, R should be matched with none, S should be matched with 1. Therefore, the predicted answer should be option (A). The true answer is also the same option (A).
	4	5	1	3	
	4	1	2	3	
	2	4	5	1	
Most repeated options	2, 4	5	none	3	Result: BS predicts **right** answer! However, it is difficult here to predict.

eQUEST provides a sophisticated, yet easy-to-use building energy analysis tool. eQUEST was designed to allow the user to perform detailed analysis of today's state-of-the-art building design technologies using sophisticated building energy use simulation techniques, but without requiring extensive experience in the "art" of building performance modeling.

ETABS Software, abbreviated for "**E**xtended **T**hree-dimensional **A**nalysis of **B**uilding **S**ystems" is a 3D integrated software that is used for structural analysis and design purposes in areas like civil engineering. It integrates every small aspect of engineering designing while also involving the production of schematic sketches.

Scan this to go to learn more about ETABS on skyfilabs.com

It is a product of Computers and Structures Inc. It is an engineering software that is used in construction. It has highly efficient structure analysis and design programs developed for catering to multi-story building systems. It is loaded with an integrated system consisting of modeling tools and templates, code-based load prescriptions, analysis methods, and solution techniques. It can handle the largest and most complex building models and associated configurations. ETABS software is embedded with CAD-like drawing tools with an object-based interface and grid representation.

CARTO is a cloud-based mapping solution for visualizing and analyzing location data. It features design and geospatial analysis tools, and allows users to share maps securely or publish them on the web.

Scan this to go to learn more about GIS solution on

SPSS (Statistical package for the social sciences) is the set of software programs that are combined together in a single package. The basic application of this program is to analyze scientific data related with the social science. This data can be used for market research, surveys, data mining, etc.
This software was developed in 1960, but later in 2009, IBM acquired it. They have made some significant changes in the programming of SPSS and now it can perform many types of research task in various fields. Due to this, the use of this software is extended to many industries and organizations, such as marketing, health care, education, surveys, etc.

Scan this to go to medium.com and learn more about SPSS

Answer (A)

Q.54 Match the terminologies of Munsell colour wheel in Group I with their corresponding descriptions in Group II.

Column I	Column II	Options
(P) Hue	(1) Addition of black to the base colour	(A) P-2, Q-4, R-5, S- 1
(Q) Chroma	(2) Radial colour variation	(B) P-4, Q-2, R-5, S-3 ✔
(R) Value	(3) Addition of white to the base colour	(C) P-4, Q-2, R-3, S-l
(S) Tint	(4) Colour variation through angular difference	(D) P-2, Q-4, R-1, S-3
	(5) Vertical colour variation	

Most repeated option:	P-2,4	Q-4,2	R-5	S-1,3
Probable answer:	(A) or (B)
Predicted answer was:	Right

Albert Munsell devoted his life to developing a color identification and notation system that prevents confusion and makes communication easier. To describe a color, there are some attributes that can be specified in mathematical detail and clarify exactly what color you are referring to:

- Hue,
- Value,
- Chroma.

Color Dimension 1: Hue
It can be thought of hues as the colors of the rainbow. If we arrange them in a circle, in a sequence from yellow, yellow-red, red, red-purple, end up with a color wheel of the hues.
Each hue includes the different colors that vary in value (dark/light) and chroma (intensity) but are part of the same hue family.
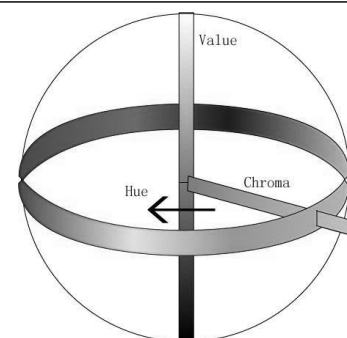

Figure: Structure of the Munsell color system in space. The 3-D Munsell Color System.
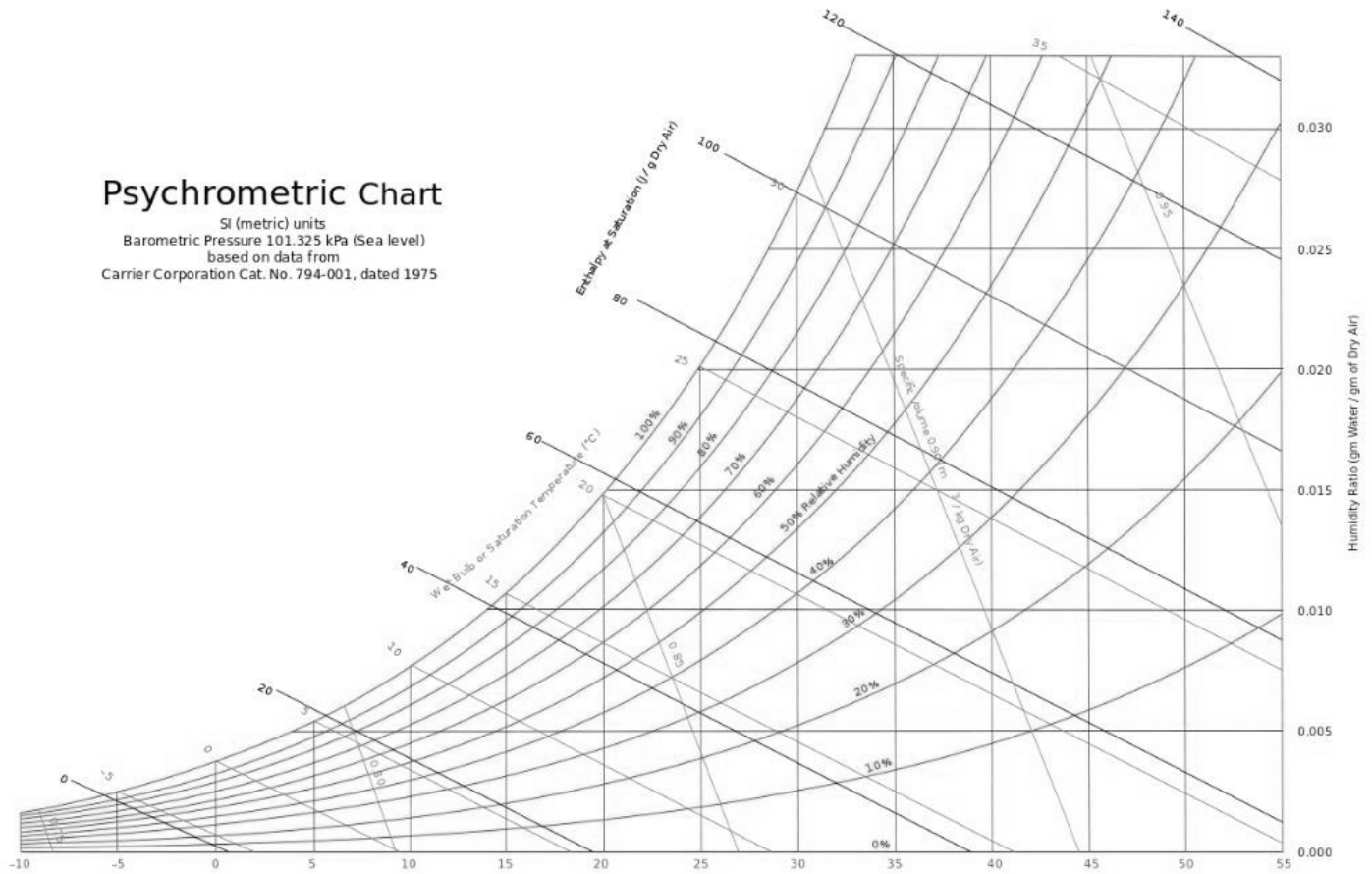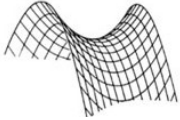
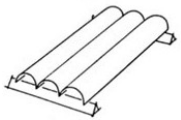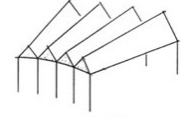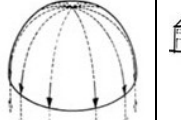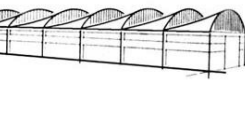Figure: **Psychrometric charts** are complex graphs that can be used to assess the physical and thermodynamic properties of gas-vapour mixtures at a constant pressure. They are often used to assess the properties of moist air. This can be useful in the design of heating, ventilation and air-conditioning systems for buildings, and **psychrometric charts** often include a zone in the middle that represents the range of conditions that people find comfortable under different circumstances (such as summer and winter).
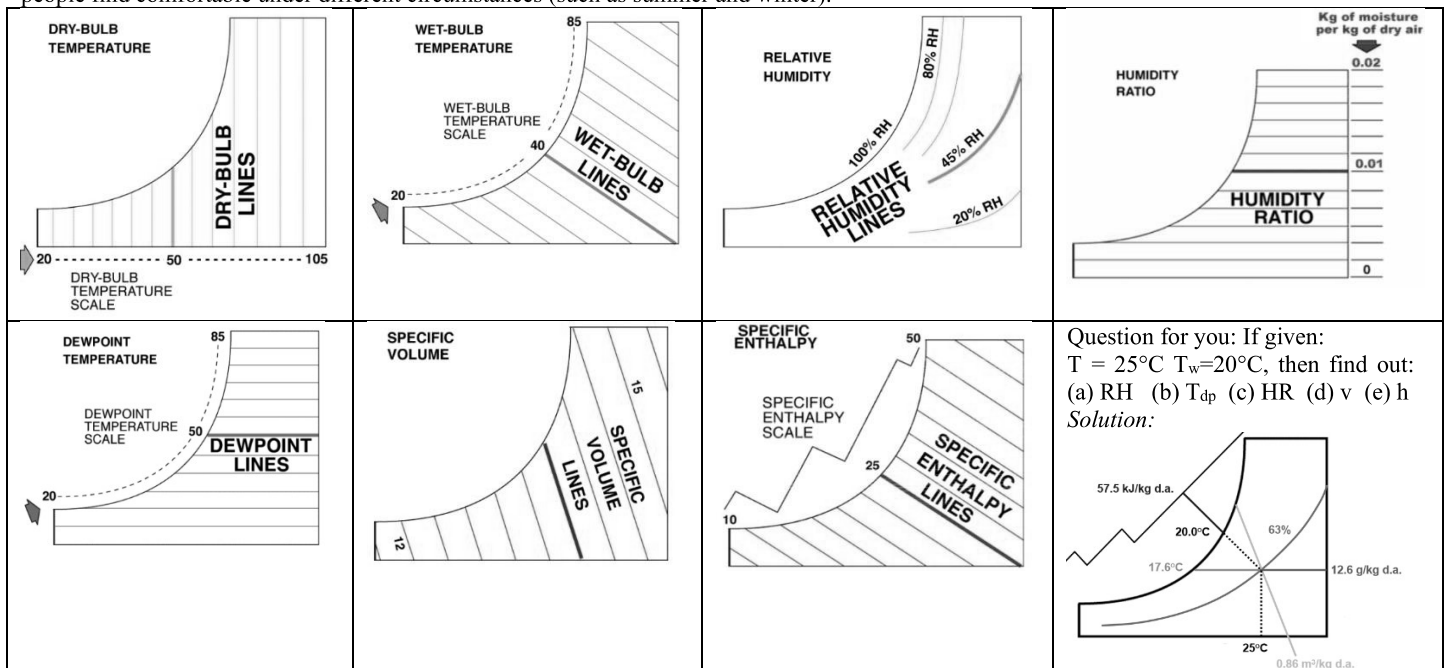
Q.58 Match the structural system in Group I with their potential causes of failure in Group II

Column I	Column II	Options
(P) Flat Slab	(l) Thrust	(A) P-3, Q-5, R-4, S-1
(Q) Long Column	(2) Flutter	(B) P-2, Q-4, R-1, S-3
(R) Arch	(3) Punching Shear	(C) P-3, Q-4, R-1, S-2 ✔
(S) Tensile Fabric	(4) Buckling	(D) P-1, Q-3, R-5, S-2
	(5) Moment	

Most repeated option:	P-3 Q-4 R-1 S-2
Probable answer:	(C)
Predicted answer was:	Right

Q.59 Match the structural form in Group I with their corresponding illustration in Group II
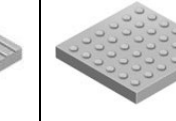
Group I				Options
(P) Cylindrical shell (Q) Dome (R) Conoid (S) Hyperbolic paraboloid				(A) P-2, Q-4, R-5, S-1 ✔
Group II				(B) P-5, Q-4, R-2, S-1
(1)	(2)	(3)	(4)	(5)	(C) P-2, Q-4, R-1, S-5
					(D) P-4, Q-1, R-5, S-2

Most repeated option:	P-2 Q-4 R-5 S-1
Probable answer:	(A)
Predicted answer was:	Right

Hypars: We use the term **hypar** to mean a hyperbolic paraboloid shape, or more formally a partial hyperbolic paraboloid, cut from the full infinite surface. The term hypar was introduced by the architect Heinrich Engel in his 1967 book *Structure Systems*

Scan this to go to illinois.edu and learn about the 3D visualization of the Hypars.

Q.60 Match the names of tactile paving in Group I with their patterns in Group II
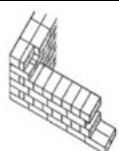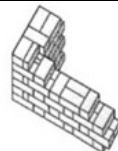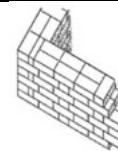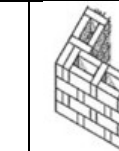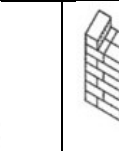
Group I (P) Lozenge (Q) Offset blister (R) Corduroy (S) Directional				Options
Group II (1) (2) (3) (4) (5)				(A) P-4, Q-2, R-3, S-1
					(B) P-3, Q-5, R-4, S-1
					(C) P-2, Q-5, R-1, S-4
					(D) P-3, Q-2, R-4, S-1 ✔

Most repeated option:	P-3 Q-2,5 R-4 S-1
Probable answer:	(D)
Predicted answer was:	Right

Tactile Paving: The key element with tactile paving is that different surface profiles are intended to denote different hazards, and these are outlined below.

There are two types of Blister paving: The most common type features 6mm high 'blisters' in a square pattern and these are used to indicate pedestrian crossings with dropped kerbs. Normally, the red-coloured units are used with light-controlled crossings, and buff for those crossings with no traffic lights. However, when natural stone units are used, this colour-coding is disregarded. The Offset Blister units are used to indicate the edge of the platform at Rail and Tram stations, also referred to as off-street applications. Note that the orientation of the offset blister units is critical - the rows of blisters MUST be parallel to the platform edge. Hazard Warning units use continuous half-rods, raised 6mm higher than the surface of the paving, to denote a hazard, such as the top/bottom of a flight of steps. Again, the rods should be parallel to the edge of the hazard. Cycleway paving uses continuous flat bars to indicate a cycle lane. The bars run parallel to the direction of travel so as not to impede cycles. Where a cycleway and a footpath are adjacent, these pavings may also be used for the pedestrian section, with the bars running transversely, and a demarcation strip between the two. Directional or Guidance paving is used to indicate the safest direction of travel for the visually impaired. The raised flat bars have rounded ends. Lozenge paving is used as a platform edge warning for on-street applications. As towns and cities rediscover the advantages of trams and Light Rail Transport (LRT), this type of paving will become more common.

Figure: There are mainly six types of Tactile Pavings.
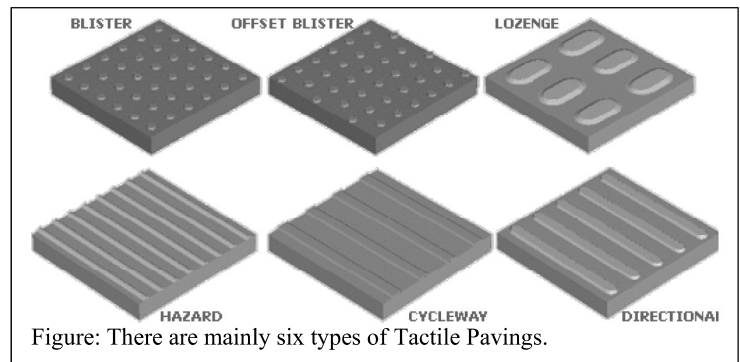
Q.61 Match the brick masonry bond type in Group I with the corresponding illustration in Group II

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

Most repeated option:	P-2,4 Q-1 R-2 S-5
Probable answer:	(D)
Predicted answer was:	Right

Q.45 The cause of short column effect, during seismic occurrence, is due to
(A) Centralized rupture of the column
(B) Tearing of reinforcement bars
(C) Buckling of column
(D) Stress concentration ✔

Short Column: During past earthquakes, reinforced concrete (RC) frame buildings that have columns of different heights within one storey, suffered more damage in the shorter columns as compared to taller columns in the same storey.
Poor behaviour of short columns is due to the fact that in an earthquake, a tall column and a short column of same cross-section move horizontally by same amount Δ (See Figure). However, the short column is stiffer as compared to the tall column, and it attracts larger earthquake force. Stiffness of a column means resistance to deformation – the larger is the stiffness, larger is the force required to deform it. If a short column is not adequately designed for such a large force, it can suffer significant damage during an earthquake. This behaviour is called Short Column Effect.
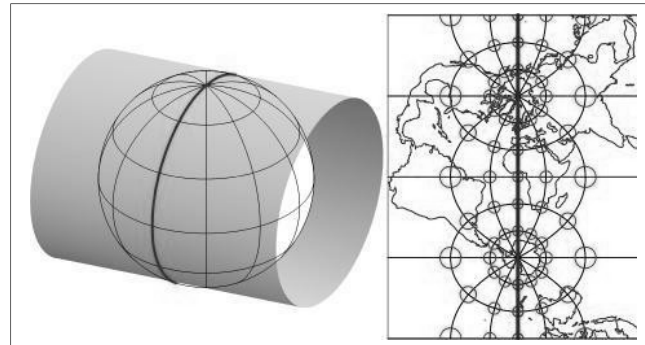(Source: http://www.iitk.ac.in/nicee/EQTips/EQTip22.pdf)

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.
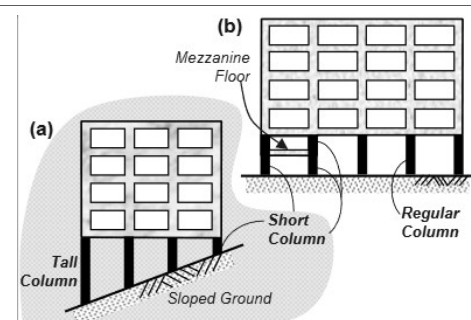

Figure: **Buildings with short columns** – two explicit examples of common occurrences.
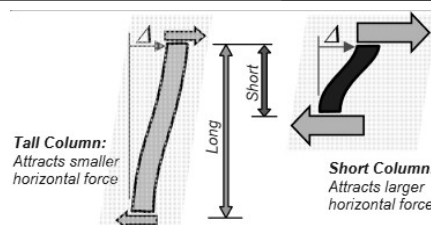

Figure: **Short columns are stiffer and attract larger forces during earthquakes** – this must be accounted for in design.The damage in these short columns is often in the form of X-shaped cracking – this type of damage of columns is due to shear failure.
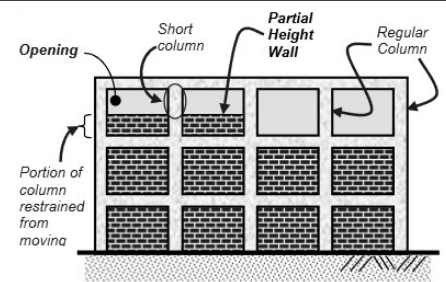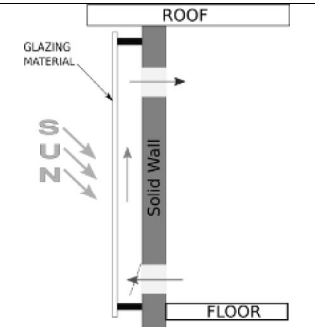

Figure: **Short columns effect in RC buildings when partial height walls adjoin columns** – the effect is implicit here because infill walls are often treated as non-structural elements.

Q.46 The solar protection system consisting of fixed slats or grids, outside a building façade in front of openings, is known as
(A) Brise soleil ✔ (B) Solarium (C) Malqaf (D) Trombe wall

Brise soleil	Solarium	Malqaf	Trombe wall
Brise soleil is an architectural feature of a building that uses a series of horizontal or vertical blades to control the amount of sunlight and solar heat that enters a building.	Solarium is a glass-enclosed porch or room used especially for sunbathing or therapeutic exposure to light. Sometimes, artificial light near to daylight spectrum is used in an enclosure.	Malqaf is a part of a complete ventilation system, consisting of a large shaft rising high above the roof of a building. The system of ventilation developed depends primarily on air movement by pressure differential, but also secondarily on air movement by convection.	Trombe walls are a type of technology that can be installed in homes to passively heat the building. The inclusion of Trombe walls reduces the need to heat the building using traditional methods such as furnaces or heaters.

Under the MGNREGA, any rural adult non-skilled worker can get a minimum 100-day job guarantee, every financial year. Every Indian rural citizen is entitled to receive employment within 15 days of registering under this scheme. Once the registration has been done, the worker is eligible for an unemployment allowance from the Government as well, if employment has not been found within the stipulated period. The *Gram Panchayats* were nominated to implement the MGNREGA across India. Initially, the minimum wages that were to be given to labourers was Rs. 100 per day.

Q.52 Associate the fire safety requirements for high rise buildings in Group-I with corresponding standards of the National Building Code of India 2016 in Group-II

Group I	Group II	Options
P. Minimum Refuge area	1. 12.5 sqm/person	(A) P-4, Q-1, R-5, S-2
Q. Maximum Travel distance	2. 2.0 m	(B) P-3, Q-5, R-4, S-1
R. Maximum Occupant load	3. 0.3 sqm/person	(C) P-3, Q-5, R-1, S-2 ✔
S. Minimum Stair case width	4. 12.0 ton	(D) P-4, Q-5, R-1, S-3
	5. 30.0 m	

	Most repeated option:	P-4,3 Q-5 R-1 S-2
	Probable answer:	(C)
	Predicted answer was:	Right

Q.53 Match the photometric quantities in Group-I with their respective units in Group-II

Group I	Group II	Options
P. Illuminance	1. Candela	(A) P-3, Q-2, R-5, S-4
Q. Luminous Intensity	2. Candela/sqm	(B) P-5, Q-4, R-2, S-1
R. Luminance	3. Lumens/sqm	(C) P-5, Q-1, R-2, S-3
S. Luminous Efficacy	4. Lumens/watt	(D) P-3, Q-1, R-2, S-4 ✔
	5. Lumens	

	Most repeated option:	P-3,5 Q-1 R-2 S-4
	Probable answer:	(D)
	Predicted answer was:	Right

Luminance describes the measurement of the amount of light emitting, passing through or reflected from a surface from a solid angle. It also indicates how much luminous intensity can be perceived by the human eye. This means that luminance indicates the brightness of light emitted or reflected off a surface. In the display industry, luminance is used to quantify the brightness of displays. The International System of Units, (SI) unit for luminance is candela/square meter (cd/m^2).

Illuminance is a term that describes the measurement of the amount of light falling onto (illuminating) and spreading over a given surface area. Illuminance also correlates with how humans perceive the brightness of an illuminated area. As a result, most people use the terms illuminance and brightness interchangeably, which leads to confusion, as brightness can also be used to describe luminance. To clarify the difference, illuminance refers to intensity of light falling onto a surface, while brightness refers to the visual perceptions and physiological sensations of light. Brightness is not a term used for quantitative purposes at all. The SI unit for illuminance is lux (lx). Lux = Lumen per meter square.

Figure: Basic difference Luminance and Illuminance

Luminous Intensity refers to the overall brightness from a lamp LED, for example, without regard to the area of the light source. Luminous Intensity = Candela = Lumen per unit solid angle.

Luminous Efficacy is a measure that indicates how efficient a light source is. It is the ratio of lumens to power or watts, so it is measured in lumen per watt (lm/W) in the International System of Units (SI). The higher the value, the more efficient a light source is.

Q.54 Associate the symbols in Group I with their meanings in Group II

Group I	Group II	Options
P.	1. Hearing impaired	(A) P-5, Q-3, R-1, S-2
Q.	2. Emergency lamp	(B) P-1, Q-5, R-3, S-4
R.	3. Electrical and Electronic waste disposal	(C) P-1, Q-3, R-4, S-5
S.	4. Biohazard	(D) P-5, Q-3, R-4, S-2 ✔
	5. Speech impaired	

	Most repeated option:	P-5,1 Q-3 R-4 S-2
	Probable answer:	(D)
	Predicted answer was:	Right

Q.26 As per revised building bye-laws, If the required setbacks are - Front 3 metres, each Side 2 metres and Rear 2 metres, then the maximum total buildable area will

(A) increase by 248 sq. m (B) increase by 40 sq. m (C) decrease by 30 sq. m (D) decrease by 40 sq. m ✔

Solution: New Coverage area will be = (15-3-2)m * (12-2-2)m = 10*8 = 80 sq.m.

So, total buildable area = 80 sq.m.*4 floors = 320 sq.m.

Therefore, 320 - 360 = - 40 sq.m. Answer

Statement for Linked Answer Questions 27 & 28:

An aerial photograph is taken from a plane with a camera lens of focal length 305 mm. The desired scale of the photograph is 1:25,000 and the height of the terrain above mean sea level is 300 metres.

Q.27 The flying height of the plane above mean sea level is

(A) 7,625 (B) 7,925 ✔ (C) 8,562 (D) 8,965

Solution: 1/25000 = 0.308/x => x = 7625

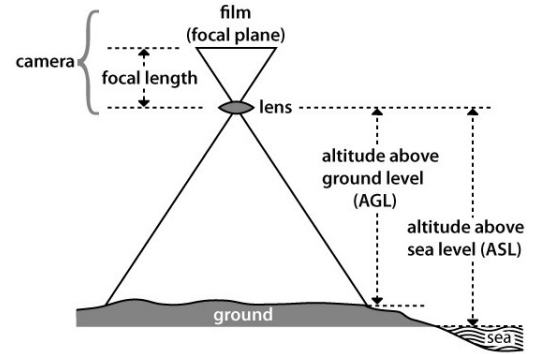So, the flying height of the plane above mean sea level

= 7625 + 300 = 7925 m Answer

Q.28 If the above photograph is taken by a camera lens of focal length 210 mm from the same flying height, then the scale of the photograph will be (A) 1 : 45,000 (B) 1 : 37,740 (C) 1 : 36,310 ✔ (D) 1 : 19,050

Solution: 7650/0.210 = 36310

So, the scale of the photograph will be 1:36310 Answer

Rule [1/scale = focal length/ height]

Statement for Linked Answer Questions 29 & 30:

A beam of cross section 300 mm x 400 mm has overhangs at both ends. The beam has a simple support of 10 metres and an overhang of 5 metres each at both ends and carrying a load of 10 kN on both the free ends.

Q.29 The maximum values of shear force and bending moment in the beam are

(A) 5 kN, 50 kN-m (B) 20 kN, 80 kN-m (C) 15 kN, 45 kN-m (D) 10 kN, 50 kN-m ✔

Solution: Shear force = 10 kN

Bending Moment = 10 kN * 5m = 50 kN-m Answer

Q.30 The maximum values of bending stress and shear stress developed in the beam in N/mm^2 are

(A) 5.15, 0.1 (B) 6.25, 0.125 ✔ (C) 7.35, 0.15 (D) 8.45, 0.175

Solution: Bending Stress = (My/I)

Where,

M= Bending moment = 50 kN-m

y= distance from neutral axis = 400mm/2 = 200mm

I= moment of Inertia = bd^3/12 = 300*(400)^3/12 = 16x10^8 [b= 200mm, d = 400mm]

So, Bending Stress = (My/I)

⇨ Bending Stress = (50 kN-m*200mm)/16x10^8 = (50*1000N*1000mm*200mm)/16x10^8 = 6.25

Shear stress = 3/2(V/A)

Where,

V = shear forece = 10 kN

A = cross-sectional area = 300x400 = 120000 mm^2

So, Shear stress = 3/2(V/A)

⇨ Shear stress = 3/2(10 kN/120000)

⇨ Shear stress = 3/2(10*1000N/120000)

⇨ Shear stress = 0.125

Statement for Linked Answer Questions 31 & 32:

An auditorium has a volume of 3000 m^3 with optimum reverberation time of 0.8 seconds.

Q.31 The sound absorption power required in the auditorium in m^2-sabins is approximately (A) 250 (B) 400 (C) 600 ✔ (D) 800

Solution: Reverberation time, t = 0.16x (V/A)

[V= volume of room, A = absorption power]

So, 0.8 = 0.16*(3000/A)

⇨ A = 600 Answer

Q.32 During a convocation programme in the same auditorium, the absorption power increases by 200 m^{2}sabins. The reverberation time in seconds will now be

(A) 0.4 (B) 0.6 ✔ (C) 0.8 (D) 1.2

Solution: New absorption power = 600 + 200 =800

So, t = 0.16*(V/A) = 0.16*(3000/800) = 0.6 Seconds Answer

Q.33 Ramsar list is related to

(A) Wetlands ✔   (B) Heritage buildings

(C) Seismic zones   (D) Special Economic Zones

film (focal plane)

camera { focal length

lens

altitude above ground level (AGL)

altitude above sea level (ASL)

ground

sea

Scan for Normal Stress, Bending Stress, & Shear Stress

Download PDF (2.5 MB) for Bending Stress & Shear Stress in beams with examples.

Figure: Example of a wetland.

Konark	Madurai	Dilwara	Mamallapuram	Sanchi
The three wheels seen in figure is a part of chariot of the Konark temple.	The Golden Lily Pond (called Potramarai in Tamil) is located inside the Meenakshi Amman Temple, Madurai.	Marble Carved Ceilings Showing Jain Mythology in Dilwara Temple, Mt. Abu	The shore temple at Mamallapuram (Mahabalipuram) consists of two Shiva shrines having vimanas.	The Toranas (Gateways) of the Great Stupa of Sanchi are the oldest freestanding gateways in India.

Q.65 The correct sequence of generic elements in a classical Order arranged from top to bottom is

(A) Architrave > Frieze > Capital > Cornice > Shaft > Pedestal > Base

(B) Architrave > Capital > Cornice > Frieze > Base > Shaft > Pedestal

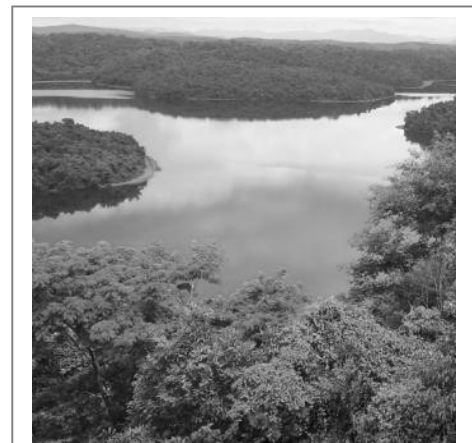(C) Cornice > Frieze > Architrave > Capital > Shaft > Base > Pedestal ✔

(D) Cornice > Capital > Frieze > Architrave > Shaft > Pedestal > Base

Q.66 Match the tree forms in Group I with their common examples in Group II.

Group I	Group II	Options
P. Broad Q. Tapering R. Conical S. Columnar	1. False Acacia 2. Holly 3. Lombardy Polar 4. Oak 5. Silver Maple	(A) P-1, Q-5, R-4, S-2 (B) P-1, Q-3, R-4, S-5 (C) P-4, Q-1, R-2, S-3 ✔ (D) P-4, Q-5, R-2, S-1
	Most repeated option:	P-1,4 Q-5 R-4,2 S-none
	Probable answer:	(A) or (D)
	Predicted answer was:	Wrong
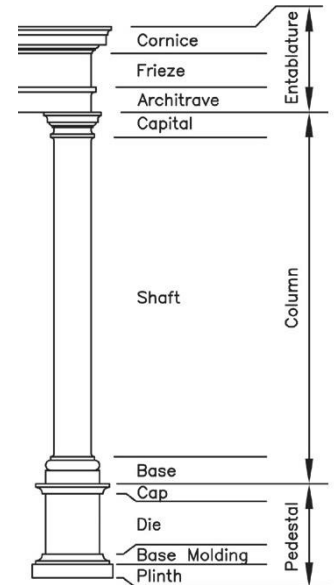
False Acacia (Black Locust)	Holly	Lombardy Polar	Oak	Silver Maple
Robinia pseudoacacia	Ilex aquifolium	Populus nigra	Quercus velutina	Acer saccharinum

Q.67 Match the descriptions in Group I with the elements of Ornamentation in Group II.

Group I	Group II	Options
P. Painting on a freshly spread moist plaster surface with powdered pigments	1. Chiaroscuro	(A) P-1, Q-2, R-3, S-5
Q. Figure incised into a stone surface or a metal plate yielding an impression in relief	2. Emboss	(B) P-1, Q-5, R-4, S-6
R. Delicate or intricate design on lattice work allowing light through openings	3. Filigree	(C) P-4, Q-2, R-3, S-1
S. Artistic composition consisting of motifs borrowed from different sources	4. Fresco	(D) P-4, Q-5, R-3, S-6 ✔
	5. Intaglio	
	6. Pastiche	
	Most repeated option:	P-1,4 Q-2,5 R-3,4 S-6
	Probable answer:	(B) or (D)
	Predicted answer was:	Right

 Chiaroscuro: (from Italian chiaro, "light," and scuro, "dark"), technique employed in the visual arts to represent light and shadow as they define three-dimensional objects.

Solution:

FBD

SFD

BMD

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

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

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

$$V_2 \dots\dots\dots\dots\dots\dots\dots = wa - R_1$$

$$V_3 \dots\dots\dots\dots\dots\dots\dots = wb - R_3$$

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

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

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

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:

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

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

$$M_2 = +\frac{FL}{8} \qquad @\ x = L/2$$
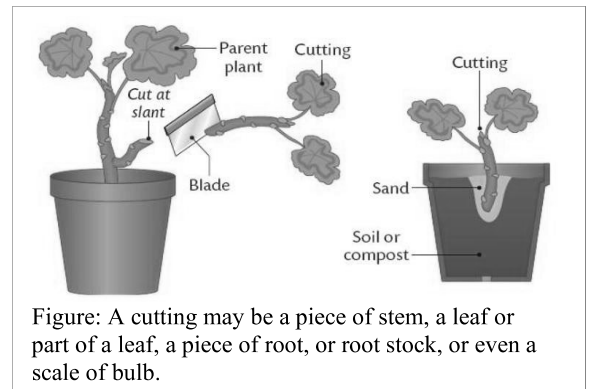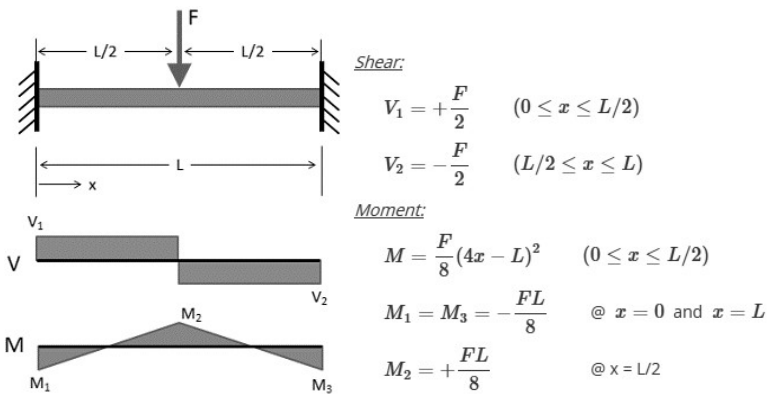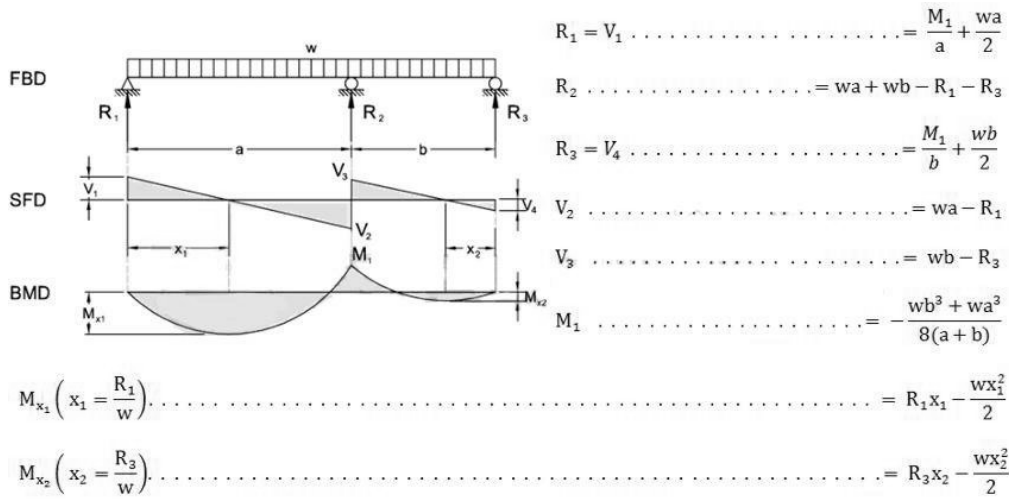
Q.12 Explain the following planting techniques:

12.1 Grafting

12.2 Layering

12.3 Cutting

12.4 Transplantation

Figure: A cutting may be a piece of stem, a leaf or part of a leaf, a piece of root, or root stock, or even a scale of bulb.
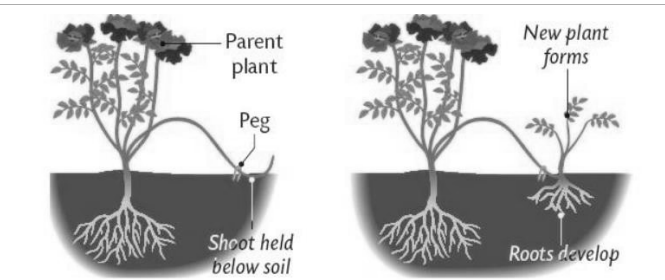

Figure: Layering is the developing of roots on a stem while it is still attached to the parent plant. The rooted stem is then detached or become a new plant growing on its own roots. A layered stem is known as a layer.

Figure: Grafting is an art of joining parts of two independent plants in such a manner that they unite and grow together into single independent plant. The part of graft combination which is to become the upper portion or the shoot system or top of the new plant is termed the scion or cion and the part which is to become the lower portion or the root system is the rootstock or under stock or some time stock. The single plant obtained as a result of union between the stock and scion is termed as Stion.
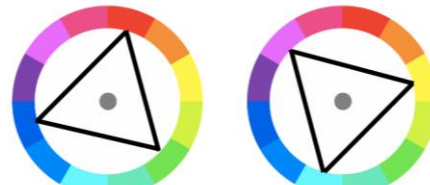

Figure: "Transplanting" refers to the act of transferring seedlings from containers in the greenhouse (cell trays, flats, pots, etc.) into the garden or field.
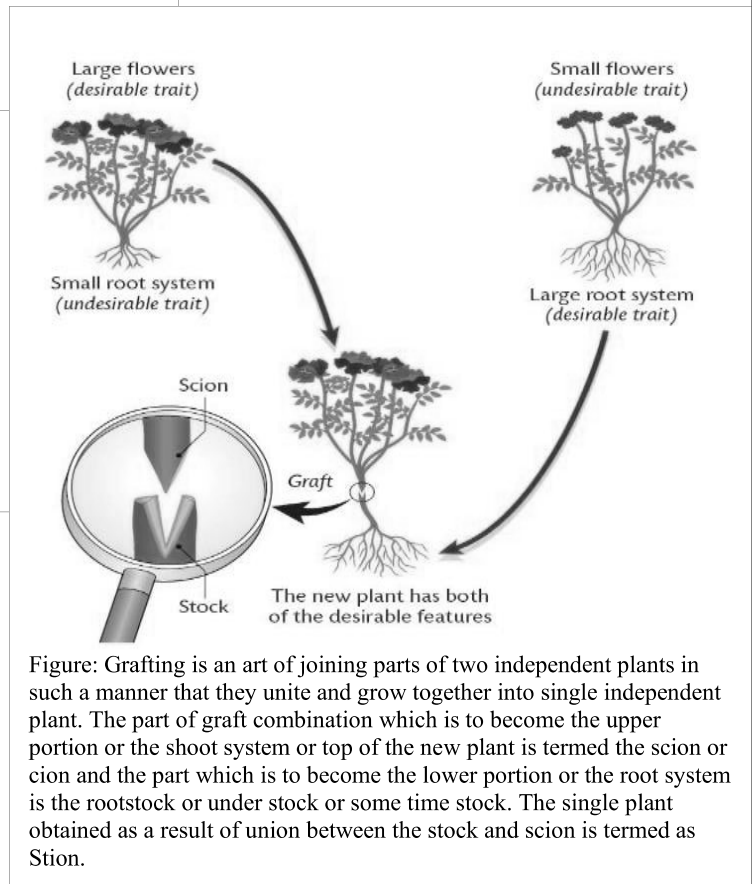
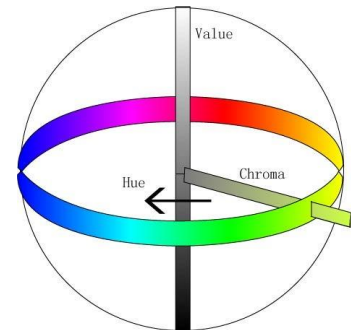GATE 2022: Pathmanabapuram Palace, Kanyakumari (Image: Flikr)

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


GATE 2021: Harris and Ullman model

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

GATE 2020: Juniperus chinensis, commonly called Chinese juniper is a Evergreen conifer with a large variety of cultivars. Landscape use depends on form and size of cultivar. Juniperus chinensis, commonly called Chinese juniper, is a dioecious evergreen conifer that is native to China, Japan, Mongolia and the Himalayas. It is often seen in the wild as a conical tree to 50' tall and 20' wide, but also appears in much shorter shrubby or spreading forms. Foliage is dark green. Brown bark on mature stems peels in strips. Although species plants are rarely sold in commerce, a large number of cultivated varieties ranging in size from large trees to large/small shrubs to low-growing groundcovers have become popular ornamental landscape plants.
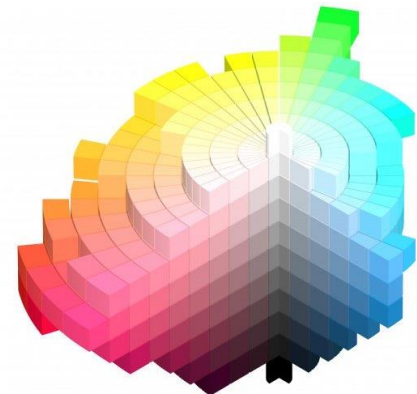
GATE 2020: A Representation of the Munsell Color Solid Cylindrical Coordinates. sRGB approximations of the 1943 Munsell color notations.
Because each color has three dimensions, an arrangement of all colors takes a three-dimensional form. The gray scale serves as the center pole, with white at the top and black at the bottom. The Munsell color solid cannot take the shape of a perfect sphere because hue families contain different numbers of steps in chroma.

Figure 2020: Bakula flowers are offered to Lord Ganesha during the 21-pushpa puja. The flowers are considered to be very sacred in Jainism and Buddhism. Mimusops elengi is Indian native plant and is used for a long time in the history of the medicine. Plant was well studied in majority of the world because of its high potential medicinal value. Traditionally all different part of this plant, namely leaf, root, fruit, seed, bark and flower are used to cure various kinds of disorders. Information compiled here will be useful to improve the present investigation of several health care research regarding the Mimusops elengi.