



# ACE

## Engineering Academy

TEST ID: 501

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ESE- 2019 (Prelims) - Offline Test Series

Test-2

GENERAL STUDIES AND ENGINEERING APTITUDE

SUBJECT: GENERAL PRINCIPLES OF DESIGN, DRAWING,  
IMPORTANCE OF SAFETY  
SOLUTIONS

01. Ans: (d)

**Sol:** Synectics is a methodology for creativity based on reasoning by analogy. Synectics recognizes four types of analogy:

- Direct Analogy: Designer searches the closest physical analogy to the situation at hand.
- Fantasy analogy: Designer disregards all problem limitations and laws of nature, physics, or reason. Instead, the designer imagines or wishes for the perfect solution to a problem.
- Personal Analogy: The designer imagines that he or she is the device being designed, associating his or her body with the device or process under consideration

So, all the four statements are correct.

02. Ans: (c)

**Sol:** Integral Architecture tends to decrease the parts in a product by integrating parts or functions of a product. Because the number of parts are decreased it decreases the overall cost and increases the speed of production. Because we are combining parts, the parts tend to become complex, so they are difficult to reproduce (copying by competition).

So, statements (1), (2) and (3) are correct.

Modular Architecture tends to decrease the product development (product design) time.

03. Ans: (c)

**Sol:** Methods in Systematic Design process are

1. Function decomposition
2. Morphological analysis
3. TRIZ/TIPS
4. Axiomatic method



**04. Ans: (a)**

**Sol:** Hazards may be classified into 3- types.

1. Within the responsibility of engineers like failure of dams, automotive accidents.
2. Which cause constraints to design like Earthquakes, Cyclones, Floods etc.
3. Socio political disruption like war, terrorism etc.

**05. Ans: (b)**

**Sol:**

- Worst case design: The parameters are set at either the lowest or largest expected values. Worst case design is an approach that accounts for the statistical nature of the environment in a deterministic way.
- Fail Safe Approach: Identify vulnerability in design that can lead to a failure and provide a means or equipment to measure/monitor it.
- One Horse Shay Approach: Design the product in such a way that all the components have equal life.
- Reliability is the measurement of the ability of a component or system to operate without failure in the service environment.

**06. Ans: (c)**

**Sol:** Situations of Hazard the correct order is:

1. Identification of Hazard
2. Analyze the Hazard
3. Decision to Avoid Hazard
4. Ability to Avoid Hazard
5. Safe Behaviour

**07. Ans: (c)**

**Sol:** A focus group is a means to elicit ideas and opinions about a specific product, service or opportunity in an interactive group environment. The participants, guided by a moderator, share their impressions, preference, and needs.

**08. Ans: (c)**

**Sol:** Team is a group of people with complementary skills working **together** to achieve common objectives of the team. Every member of the team takes the responsibility of success. Decisions are made by the team based on democracy. Communications are encouraged in a team.

**09. Ans: (a)**

**Sol:** Triangle pyramid resting on its base on the HP with its base side  $45^0$  to VP then we one hidden slant edge in the front view.



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**10. Ans: (c)**

**Sol:** (a) Design Documentation is very essential at every stage of the design process.

(b) Design process requires a minimum of 4 steps (Inputs, Process steps, Outputs, Feedback)

(c) Design Testing Methods are: Mockups, Models and Prototypes

(d) Virtual prototyping is generally less expensive than prototyping

**11. Ans: (c)**

**Sol:**

- Design Testing is performed in Embodiment Design
- Make or Buy Decisions are performed during Detail Design
- Design sketches are built and used during conceptual design
- Drawings are released for manufacture after detail design

**12. Ans: (c)**

**Sol:** Statement (5) is incorrect.

As Mock-ups are built during conceptual design stage.

**13. Ans: (c)**

**Sol:** Alpha testing is done during embodiment design.

Virtual prototyping is done at the end of embodiment design.

**14. Ans: (d)**

**Sol:** Here the motor is designed to meet specific Customer request. So as per the definitions of types of Design:

- **Redesign – Fix** → To Modify the design based on Customer complaints on the product.
- **Redesign – Update** → To Modify the design based on Customer feedback to improve the product.
- **New Product Design** → To Build a new design from scratch.
- **Adaptive Design** → To Modify the design to adapt to a particular customer request.

**15. Ans: (b)**

**Sol:** Types of Design are:

**Main Types:** Adaptive Design, Redesign or Developmental Design and New Product Design

**Auxiliary Design Types:** Selection Design, Industrial Design

**16. Ans: (d)**

**Sol:** A **fail-safe** in engineering is a design feature or practice that in the event of a specific type of failure inherently responds in a way



that will cause no or minimal harm to other equipment, the environment or to people.

- (a) Safety fuses are designed to prevent damages in surges in voltages
- (b) Pressure valves used in compressors check on safety on pressure
- (c) Air brakes on railway trains and air brakes on trucks. The brakes are held in the "off" position by air pressure created in the brake system. Should a brake line split, or a carriage become de-coupled, the air pressure will be lost and the brakes applied, by springs in the case of trucks, or by a local air reservoir in trains. It is impossible to drive a truck with a serious leak in the air brake system.
- (d) Tools are used to decrease the effort or increase the productivity.

**17. Ans: (d)**

**Sol:** Modular Design decreases the product development cycle time because each of the module can be assigned to an individual designer to develop. There by modules can be developed simultaneously.

Modular design increases flexibility by adding or deleting modules.

Modular design is the arrangement of physical elements into groups based on their function called modules.

Integral architecture is driven by DFMA to integrate various parts, functions to decrease the number of parts, overall weight of the product and there by the cost of the product.

**18. Ans: (b)**

**19. Ans: (d)**

**Sol:**

- Foam is not effective to stop the leakages of the gas fuel or to stop the oxygen exposure to the fire.
- Foam is an effective fuel for solid types of fuels.
- Foam contains water so it cannot be used for fire caused by electrical short circuit.

**20. Ans: (b)**

**Sol:**

- Toxic gases which come out of the fire tend to escape through the lifts or internal stairs which can affect the people who try to escape.
- Fire safety Volunteers who are trained by the organization for fire situation emergencies shall help the people get out



of the building to a safe point pre-determined by the fire safety department.

- People should be discouraged from running out the building in case of fire as it results in inhaling excess toxic gases that may affect them.
- Alerting others in case of fire can minimize casualties.
- Identifying the source of fire and informing about it can help the fire fighters.

**21. Ans: (a)**

**Sol:** When a solid is freely suspended (hanged) in air from one of its point then the line joining the hanging point to the centre of gravity will be always a vertical irrespective of the solid shape.

**22. Ans: (c)**

**Sol:** In general, after determining the orthographic views horizontal plane is rotated at  $90^0$  in clockwise direction. Hence, 1 is correct.

In orthographic projections elevation reflects on vertical plane and plan reflects on horizontal plane. For first angle projections, vertical plane is above the reference line and horizontal plane is below the reference line. Hence, 2 correct.

**23. Ans: (d)**

**Sol:** The purpose of the title box is to provide information regarding identification, administration and interpretation of the whole drawing such as Name of the firm, Title of the drawing, Scale, Sheet number, Symbol, denoting the method of projection etc.,

**24. An: (b)**

**Sol:** The following steps are followed to construct a scale

- Determine the R.F
- Length of the scale = R.F value \* maximum length
- Draw a line as per length of the scale and divide it into a equal number parts as per the units and later its main scale division into sub-unit number of equal parts.

**25. Ans: (b)**

**Sol:** When a vertical cone is standing on the ground (horizontal plane) is cut by a vertical section plane (cutting plane) not passing through the apex (vertex) the true shape of section is a rectangular hyperbola. If it is passing through the apex, then the true shape of section will be of triangle.



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26. Ans: (c)

**Sol:** Hyperbola is a curve traced by the point moving in such a manner that the difference of its distance from the two fixed point is always constant and it will be always equal to its transverse axis length.

27. Ans: (b)

**Sol:** When a line is inclined to both horizontal plane and vertical plane then following are the possible positions of the traces:

If one end of the line closer to Horizontal plane then both H.T and V.T are below the XY line. Hence, (a) is correct.

If one end of the line closer to vertical plane then both H.T and V.T are above the XY line. Hence (c) is correct.

If one end of the line is on Horizontal plane and the other end is in Vertical plane then H.T is below XY and V.T above XY. Hence, (d) is correct.

But for a line first quadrant keeping in any position, H.T above the XY and V.T below the XY is not possible (b) is incorrect.

28. Ans: (b)

**Sol:** When a line is kept parallel to Vertical Plane and inclined to Horizontal Plane then irrespective of the quadrant, its front view (elevation) appears as an inclined line of true length and top view (plan) is a foreshortened length. Hence, (b) is correct.

The position of Traces depends on the quadrant. For a line in I or IV quadrant horizontal trace will be below the reference (XY) line and if the line is in II or III quadrant horizontal trace will be above the reference (XY) line. Hence position of the traces (d) cannot be judged.

29. Ans: (d)

**Sol:** As per conventional representation, the actual position of an object is designated by capital letters such as A, B, C, etc; its elevation which reflects on vertical plane is represented by lower-case letter with dash as a', b', c', and plan reflected on horizontal plane is represented by lower-case letter. Hence, 1, 2 and 3 are correct.

30. Ans: (c)

**Sol:** The locus of the point on a line rolling over a circle is an **involute**. Hence, 1 is correct.

An **epicycloid** is defined as the locus of a point on the circumference of a circle which rolls without slip around the outside of another circle. Hence, 2 is correct.

An **Involute** is a curve traced by the free end of a thread unwound from a circle or a polygon in such a way that the thread is always tight and tangential to the circle or side of the polygon. Hence, 3 is also correct.





31. Ans: (d)

Sol: When a plane is parallel to reference plane then it shows the true shape of the plane, but when the plane perpendicular to reference plane, looks like a straight line.

32. Ans: (b)

Sol:



33. Ans: (d)

Sol: When a rectangle plate is hanged vertically then its plan and profile view will be a straight line. Hence, 1 and 2 are correct.

Its elevation will be the true shape of the plate. Hence, 3 is incorrect.

When a plane is freely hanged vertically then the line joining the hanged point to the centroid of the plane will be a vertical line. Hence, 4 is correct.

34. Ans: (b)

Sol: Helix is the three dimensional curve that is generated by a point which moves around the surface of a right circular cylinder and at the same time advances in the axial direction at a speed which bears a constant ratio to the speed of rotation.

Hence, statement 1 is incorrect.

An oblique hyperbola will have the angle between its asymptote less than  $90^0$ .

Hence, statement 2 is correct.

35. Ans: (c)

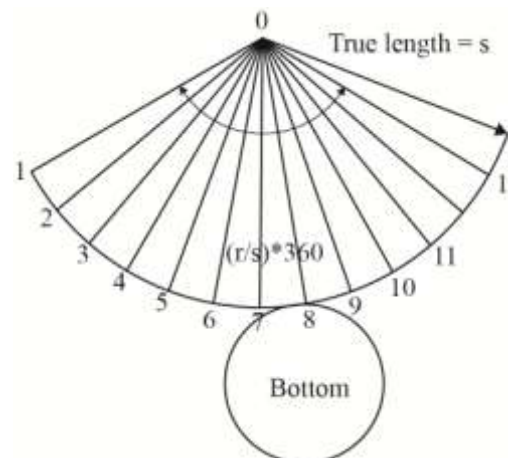
Sol: Ellipse is the curve traced by a moving point in such a manner that the sum of its moving point distance from two fixed points ( $f_1, f_2$ ) is always constant and is equal to major axis.

36. Ans: (d)

Sol: Front view inclination ( $\alpha$ ) with XY reference line  $>$  true inclination with HP ( $\theta$ ) and top view inclination ( $\beta$ ) with XY reference line  $>$  true inclination with VP ( $\Phi$ ). Hence d is correct

37. Ans: (b)

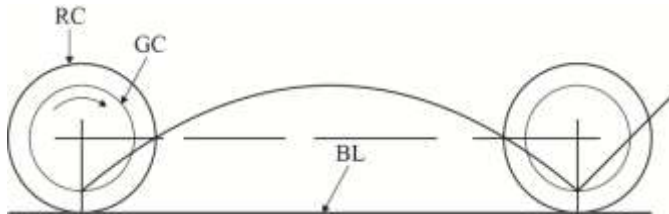
Sol: The base of the cone is a circle, with a circumference equal to the length of the curved line.





**38. Ans: (b)**

**Sol:** The point is inside the circumference of the rolling circle it is called inferior and the circle is rolling on the straight line then the curve is called inferior trochoid.



**39. Ans: (c)**

**Sol:** When a Square pyramid is resting on its base on the H.P. and all the edges of the base are equally inclined to the V.P then the maximum number of point of intersections is  $n+1 = 4+1 = 5$  (where  $n$  = number of sides of the base)

**40. Ans: (d)**

**Sol:** The cylinder is cut by an auxiliary inclined plane (cutting plane inclined to HP and Perpendicular to VP). The V.T. of the section plane will cut the solid passing through the top point of generator. The true shape of the section appears as an ellipse by viewing perpendicular to the sectional plane.

**41. Ans: (b)**

**Sol:** Statement (I) defines **Fail Safe** method in design for reliability.

Statement (II) defines **Worst Case** design method in design for reliability.

**42. Ans: (a)**

**Sol:** In oblique projections front face of the object is kept parallel to the plane of projection the receding axis (which is actually perpendicular) to the plane of projection is drawn at an inclination.

Hence, statement (I) is correct.

By reducing the length of the receding lines, the distortion can be reduced hence statement (II) is also correct and statement (II) is a supporting statement of statement (I).

**43. Ans: (b)**

**Sol:** Statement (I) explains the safety education and training for all workers periodically. Statement (II) talks about new employee orientation.

**44. Ans: (a)**

**Sol:** When the face of a cube is resting on the ground with its faces equally inclined to vertical plane then the maximum number of point of intersection is  $(n + 2 = 4 + 2 = 6)$  hence statement (I) and (II) are correct and statement (II) is the supporting statement of Statement (I).



45. Ans: (d)

**Sol:** Safety policy and goals shall be subjected to periodic revisions and updates to implement technological upgrades scientific new methods to prevent accidents.

46. Ans: (a)

**Sol:** In isometric projections all the axes are equally inclined to each other and all the dimensions are measured.

Hence, statement (I) and (II) are correct. Statement (II) is a supporting statement of statement (I).

47. Ans: (b)

48. Ans: (b)

**Sol:** Epicycloid is a curve traced by a point on the circumference of a circle which is rolled over another circle.

The angle subtended is:

$$\theta = \frac{r}{R} * 360^{\circ}$$

= (Rolling circle radius / directing circle radius) \*  $360^{\circ}$

If the rolling circle radius (r)=directing circle radius(R) then  $\theta= 360^{\circ}$  the Epicycloid curve will be a Cardioid. But instead a point on the circumference of a rolling circle if it is inside the circumference of the circle then that curve is called inferior epi-trochioid.

Hence, statement (I) and (II) is individually correct, but statement (II) is not the supporting statement of Statement (I).

49. Ans: (a)

**Sol:** A pyramid contains a number of isosceles triangle faces and its lateral surface will be set of isosceles triangle. Hence, statement (I) is correct.

The true slant edge of a pyramid is measured in elevation if its corresponding plan is a horizontal line parallel to the reference (XY) line which represents the line is inclined to Horizontal plane and parallel to the vertical plane. Hence, statement (II) is also correct and statement (II) is the supporting statement of Statement (I).

50. Ans: (a)

**Sol:** Carbon dioxide are very good fire extinguishers for fires involving situations of stagnant fires caused by liquid fuels because carbon dioxide works by cutting the supply of oxygen and does not leave any residue.

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AIR 5  AIR 6  AIR 6  AIR 6  AIR 6  AIR 7  AIR 7  AIR 7  AIR 7 																				
AIR 7  AIR 7  AIR 7  AIR 7  AIR 8  AIR 8  AIR 8  AIR 9  AIR 9 																				
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E	TOP 10	TOP 100	E	TOP 10	TOP 100	C	TOP 10	TOP 100	M	TOP 10	TOP 100	C	TOP 10	TOP 100	N	TOP 10	TOP 100	P	TOP 10	TOP 100
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TOTAL SELECTIONS			196	C	86	M	44	E	36	E & T	30



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