

ESE-2019 PRELIMS TEST SERIES

Date: 03rd November, 2018

GS PAPER-I (TEST-05) OBJECTIVE SOLUTION... 

ANSWERS

1. (d)	18. (b)	35. (a)	52. (c)	69. (d)	
2. (a)	19. (b)	36. (c)	53. (c)	70. (a)	86. (c)
3. (d)	20. (d)	37. (d)	54. (a)	71. (a)	87. (c)
4. (c)	21. (a)	38. (d)	55. (a)	72. (a)	88. (b)
5. (b)	22. (c)	39. (a)	56. (d)	73. (d)	89. (a)
6. (c)	23. (a)	40. (c)	57. (d)	74. (c)	90. (c)
7. (b)	24. (c)	41. (a)	58. (d)	75. (b)	91. (a)
8. (c)	25. (d)	42. (b)	59. (b)	76. (c)	92. (a)
9. (b)	26. (b)	43. (c)	60. (d)	77. (b)	93. (c)
10. (b)	27. (d)	44. (c)	61. (d)	78. (b)	94. (a)
11. (d)	28. (d)	45. (b)	62. (c)	79. (d)	95. (a)
12. (d)	29. (d)	46. (b)	63. (d)	80. (a)	96. (a)
13. (a)	30. (d)	47. (b)	64. (d)	81. (d)	97. (b)
14. (c)	31. (d)	48. (d)	65. (c)	82. (b)	98. (a)
15. (b)	32. (c)	49. (d)	66. (b)	83. (c)	99. (b)
16. (c)	33. (d)	50. (d)	67. (d)	84. (c)	100. (c)
17. (d)	34. (c)	51. (c)	68. (a)	85. (b)	

1. (d)

For coils in series $\frac{1}{k_{eq}} = \frac{1}{k_1} + \frac{1}{k_2}$

$$\therefore k_{eq} = \frac{10 \times 5}{10 + 5} \text{ (where } k \text{ is stiffness)}$$

load = stiffness \times deflection

$$= \frac{10 \times 5}{15} \times 15$$

$$= 50 \text{ N}$$

2. (a)

3. (d)

Brainstorming is a technique of generating many idea with hope that few good ideas will develop into something workable and it includes all the above options

4. (c)

5. (b)

The first stage of testing and implementation of a new product, called prototyping consists of building a fully operational production of the complete design solution.

6. (c)

Adopting a known solution to satisfy a different need is called Adoptive design

7. (b)

Reverse engineering

Reverse engineering deals with extraction of elements and data from an already existing product

8. (c)

9. (b)

Ergonomics is the human factor in engineering. It is the study of how people interact with machines.

10. (b)

$$\text{Stress developed} = \frac{\text{load}}{\text{Area}}$$

$$= \frac{7 \times 10^3 \text{ N}}{\pi \left(\frac{14}{200} \right)^2 \text{ m}^2}$$

$$= 454728.9 \frac{\text{N}}{\text{m}^2}$$

$$= 0.455 \text{ MPa}$$

11. (d)

The major factors of accident according to human factor theory are

- (i) overloading
- (ii) Inappropriate activities
- (iii) Inappropriate response

12. (d)

13. (a)

PHA (Primary Hazard Analysis) can also serve as a guide for future detailed analysis.

14. (c)

FMEA

The purpose of FMEA is to eliminate or reduce failures starting with high priority ones.

and it minimizes late changes and associated cost.

15. (b)

Correct sequence is

- (a) Establish study objectives and scope
- (b) From HAZOP team
- (c) Collect relevant information
- (d) Perform analysis of all major pieces of equipments and supporting items
- (e) Document the study

16. (c)

17. (d)

18. (b)

The 4 c's of engineering design are

- Creativity
- Complexity
- Choice
- Compromise

19. (b)

Reliability is the ability of a component to function under conditions for a specified period of time.

20. (d)

Brain storming is a part of creative thinking to solve problems not manufacturing process management.

21. (a)

22. (c)

Shallow foundations

- (i) These are used when the soil has sufficient strength within a short depth.
- (ii) They need sufficient plan area to transfer the heavy loads
- (iii) These heavy loads are sustained by the reinforced concrete columns or walls of much less area of cross section.

23. (a)

Hoop stress = $\frac{pd}{2t}$ where p is pressure

t = thickness

d = diameter = $\frac{2 \times 1250}{2 \times 12} = 104.16$ MPa

24. (c)

$\sigma_h = \frac{pd}{2t}$ (cylinder)

$\sigma_h = \frac{pd}{4t}$ (for sphere)

thus spheres are preferred.

25. (d)

26. (b)

Welding cables should be always fully insulated.

27. (d)

28. (d)

Craftsmanship not only means doing good work but also doing it in safe way. Thus a good craftsman should be a safe worker as well.

29. (d)

30. (d)

31. (d)

32. (c)

M.B. lal committee made a report/recommendation after tragic accident of IOCL depot at Sitapura (outskirt of Jaipur)

33. (d)

Use of cranes in construction uses all the above options

34. (c)

During a fire breakout the time available for safe exit is quite low. In case of aeroplane accidents it is only few seconds. so, it is advisable to leave your belongings.

35. (a)

OSHA requires that bridge workers use eye hand face protection, including safety glasses and face shields, at all times. Eye and facial injuries typically happen because foreign objects and particles enter the eye while welding, cutting, grinding nailing, or working with concrete. People working on bridges and roadways are required to wear special colorful and reflective clothing. It makes workers visible to drivers in work zones, which helps prevent accidents before they happen.

36. (c)

When more than one person is working on a machine. The person who knows all the instructions should operate the machine.

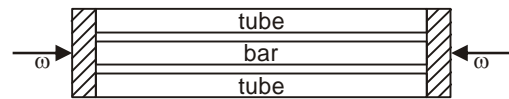
37. (d)

Customer evaluation method is useful in satisfying customers need not in relative comparison of design concepts for evaluation

38. (d)

39. (a)

40. (c)



Compatibility condition is

Elongation in bar = Elongation in tube

$$\frac{\omega_1 L}{A_1 E_1} = \frac{\omega_2 L}{A_2 E_2}$$

$$\frac{\omega_1}{A_1 E_1} = \frac{\omega_2}{A_2 E_2}$$

∴ L is same

41. (a)

$$\text{Stress} = \left[\frac{\text{Expansion prevented}}{L} \right] E$$

$$\text{Change in length} = [L\alpha\Delta T - L]$$

where L = original length

α = coefficient of thermal expansion

ΔT = change in temp.

42. (b)

$$\text{Speed ratio} = \frac{1}{\text{train value}}$$

43. (c)

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The life of a ball bearing

$$L = \left(\frac{C}{P}\right)^3 L_{10}$$

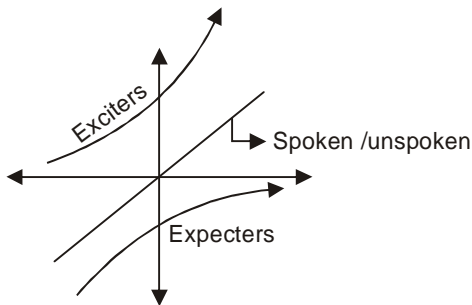
where C - dynamic load capacity and P is equivalent load.

If dynamic capacity is increased 2 times

$$L_1 = \left(\frac{2C}{P}\right)^3 L_{10} = 2^3 L$$

$$= 8 L$$

44. (c)



45. (b)

46. (b)

47. (b)

48. (d)

49. (d)

50. (d)

The purpose of building code is to protect public health safety and general welfare as they relate to the construction and occupancy of building and structures.

The building code becomes law of a particular jurisdiction when formally enacted by the appropriate governmental or private authority.

51. (c)

52. (c)

This is the form of smoke control whose aim is to exclude smoke from the escape stair ways.

53. (c)

PESO (Petroleum and explosive safety organization) control and administers the usage of explosives petrol station (Refinery, Petrochemical) in India. and its Headquarter is in Nagpur.

54. (a)

The designer should understand how the product can be manufactured, operated and disposed safely.

55. (a)

The union cabinet at 13.6.18 approved the proposal for introduction of Dam safety Bill, 2018 in the parliament the objective is to help develop uniform countrywide procedures of ensuring safety of dams.

56. (d)

These all are related to dam safety bill 2018. of GOI.

57. (d)

Hazard involve in tunneling and under ground works arise due to

- (a) Drilling
- (b) Explosive and blasting
- (c) Mucking plant and equipment
- (d) Supporting the excavation

58. (d)

59. (b)

Design speed is speed at which individual vehicles can travel with safety on the highway when weather conditions are conducive.

60. (d)

61. (d)

62. (c)

The chasnala mine disaster occurred on the evening of 27 Dec. 1975 and killed 372 miners in Dhanbad (Jharkhand) which rocked the chasnala colliery in Dhanbad.

It was so severe that the mine collapsed and millions of gallons of water from nearby reservoir rushed into the pits at a rate of seven million gallons per minute.

63. (d)

64. (d)

65. (c)

It is the case of hypocycloid. for the locus to be straight line radius of a generating circle which is moving inside the directing circle should be half of radius of directing circle.

R → radius of directing circle

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$r \rightarrow$ radius of generating circle

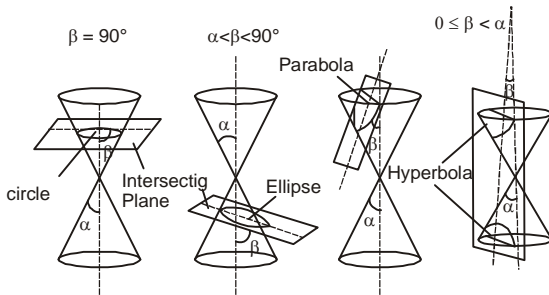
$$r = \frac{R}{2}$$

$$R = 2 \times 40 = 80 \text{ cm}$$

66. (b)

When the cutting plane cuts both the parts of the double cone, the section is a hyperbola. The cutting plane for the hyperbola should not pass through the apex and its inclination should be less than half of the apex angle i.e. $\beta < \alpha$.

When the cutting plane is parallel to the axis of the cone at a distance the section is rectangular hyperbola i.e. $\beta = 0$.

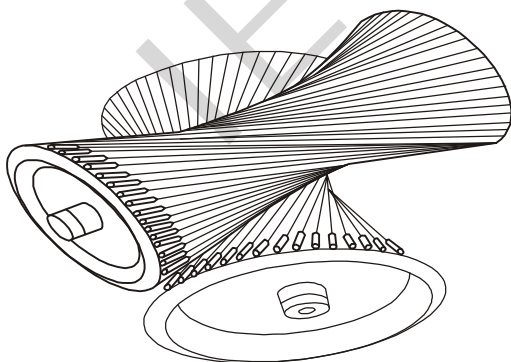


67. (d)

Whispering galleries is the application of ellipse. Cooling tower, water channels, reflecting telescopes has the application of hyperbolas.

68. (a)

Gear transmission:- Two hyperboloids of revolution can provide gear transmission between two skew axes. the cage of each gear are a set of generating straight lines.



Hyperboloidal gear transmit motion to a skew shaft

69. (d)

A scale is defined as the ratio of the linear dimensions of the object as represented in a drawing to the actual dimensions of the same.

- Drawings drawn with the same size as the objects are called full sized drawing.
- It is not convenient, always, to draw drawings of the object to its actual size. e.g. Buildings,
- Heavy machines, Bridges, Watches, Electronic devices etc.
- Hence scales are used to prepare drawing at
Full size
Reduced size
Enlarged size

BIS Recommended Scales are shown

	1:2	1:5	1:10
Reducing 1: Y (Y > 1)	1:20 1:200 1:2000	1:50 1:500 1:5000	1:100 1:1000 1:10000
Enlarging Scales	50:1 5:1	20:1 2:1	10:1
Full size scales			1:1

Intermediate scales can be used in exceptional cases where recommended scales can not be applied for functional reasons

70. (a)

If x is equal to y in $RF = x:y$ then it called as full size scale.

Representative fraction (R.F.)

$$R.F. = \frac{\text{Length of an object on the drawing}}{\text{Actual Length of the object}}$$

When a 1 cm long line in a drawing represents 1 meter length of the object

$$R.F = \frac{1 \text{ cm}}{1 \text{ m}} = \frac{1 \text{ cm}}{1 \times 100 \text{ cm}} = \frac{1}{100}$$

71. (a)

Plain scale:-

- A plain scale is used to indicate the distance in a unit and its nest subdivision.
- A plain scale consists of a line divided into suitable number of equal units. The first unit is subdivided into smaller parts.
- The zero should be placed at the end of the 1st main unit.
- From the zero mark, the units should be numbered to the right and the subdivisions to the left.

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- The units and the subdivisions should be labeled clearly.
- The R.F. should be mentioned below the scale.

72. (a)

Vernier Scale

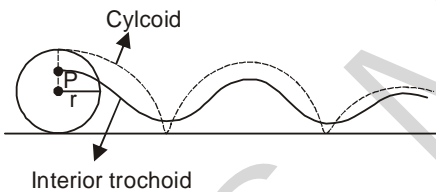
- Similar to Diagonal scale, Vernier scale is used for measuring up to second decimal.
- A vernier scale consists of (i) a main scale and (ii) a vernier.
- The mainscale is a plain scale fully divided in to minor divisions. A subdivision on the main scale is called the main scale division (MSD).
- The graduations of the vernier are derived from those on the primary scale. A subdivision on the vernier scale is called the vernier scale division (VSD).

Least Count (LC) is the minimum length that can be measure precisely by a given vernier scale.

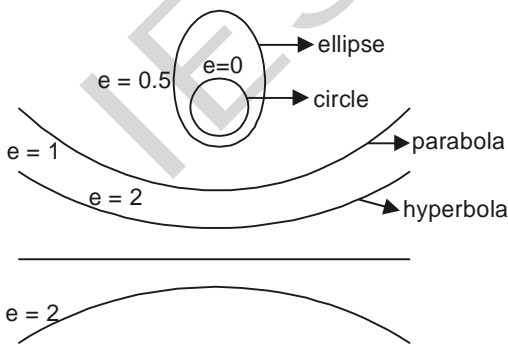
73. (d)

Ellipse, parabola and hyperbola are the three types of conics and circle is a special kind of ellipse.

74. (c)

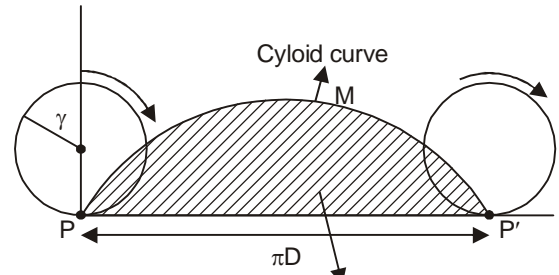


The curve traced by point 'p' will be interior trochoid.



Circle (e = 0), ellipse (e = 1/2), parabola (e =1) and hyperbola (e = 2).

75. (b)



area under the cycloid curve

arc length (PMP') = 8r

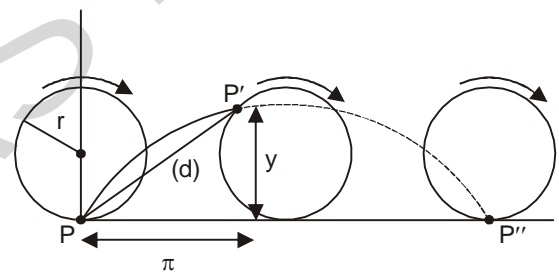
area under the cycloid curve = 3πr²

ratio = $\frac{\text{area under the cycloid}}{\text{arc length}} = \frac{3\pi r^2}{8r}$

= $\frac{3\pi r}{8} = \frac{3 \times 3.14 \times 30}{8} = 35.325$

76. (c)

The curve generated would be a cycloid



Parametric equation of the cycloid is given as below

x = r(θ) - r sin θ = r(θ - sin θ)

y = r - r cos θ = r(1 - cos θ)

θ = $\frac{\pi}{6}$

displacement = $\sqrt{x^2 + y^2}$

x = 10 $\left(\frac{\pi}{6} - \sin \frac{\pi}{6}\right)$

= 10 (0.5233 - 0.5)

= 10 × 0.0233

= 0.233

y = 10 (1 - cos $\frac{\pi}{6}$)

= 10 (1 - 0.866)

= 1.339

disp = $\sqrt{0.233^2 + 1.339^2}$

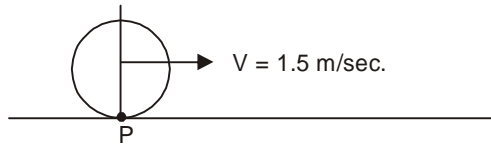
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= 1.359 cm ≈ 1.36 cm

77. (b)



$x = r(\theta - \sin \theta); y = r(1 - \cos \theta)$

$\theta = \omega t$

$\omega = \frac{v}{r} = \frac{3}{1.5} = 2 \text{ rad/sec}$

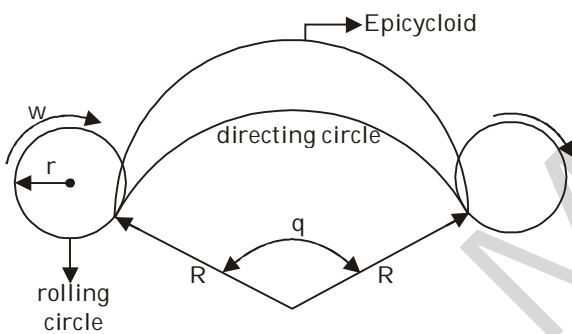
$\theta = 2 \times \frac{\pi}{2} = \pi$

$x = 1.5(\pi - \sin \pi); y = 1.5(1 - \cos \pi)$

$x = 1.5\pi \quad y = 3 \text{ m}$

displacement = $\sqrt{(1.5\pi)^2 + 3^2} = 5.584\text{m}$

78. (b)



$\frac{R}{2r} = 0.5$

$\frac{R}{r} = 1$

$R\theta = 2\pi r$

$\theta = 360^\circ$

79. (d)

Four centering marks are provided to facilitate positioning of the drawing sheets for photocopying, scanning etc. The marks are placed at the centre of each four sides..

Two orientation marks are provided to indicate the orientation of the drawing sheet on the drawing board. The orientation marks are placed across the frame, one at shorter side and one at longer side coinciding with the centering marks on those sides

Title box – An important feature on every drawing

sheet. This is located at the bottom right hand corner of every sheet and provides the technical and administrative details of the drawing. The title box is divided into two zones

- a. Identification zone : In this zone the details like the identification number or part number, Title of the drawing, legal owner of the drawing, etc. are to be mentioned.
- b. Additional information zone : Here indicative items like symbols indicating the system of projection, scale used, etc., the technical items like method of surface texture, tolerances, etc., and other administrative items are to be mentioned.
- Grid reference system – This is provided on all sizes of industrial drawing sheets for easy location of drawing within the frame. The length and the width of the frames are divided into even number of divisions and labeled using numerals or capital letters.

80. (a)

81. (d)

All of the above statements are correct and RHSV is on the left side of front view.

82. (b)

Different lines in dimensioning –

1. Dimension line –It is continuous narrow line, drawn parallel to edge or surface whose measurement is to be shown.
2. Extension line /Projection line – IT is continuous narrow line drawn perpendicular to the outline to be dimensioned and without leaving a gap from the outline or a visible gap of 1.5 mm from the outline. Projection lines are thin continuous lines stretched out from the outlines for dimensioning and extended 2 to 3 mm beyond the dimension lines
3. Leader lines /Pointer lines – A leader line is line referring to a feature (object, outline, and dimension). Leader line should be inclined to the horizontal at an angle ≥ 30 degrees.

83. (c)

Line is a type of curve having null curvature. The curves can be 2-D called plane curve or a 3-D called space curve. In engineering practice, a number of objects contain plain algebraic curve of two degree called conic section.

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84. (c)

A conic section is a curve obtained by cutting a right circular cone with the help of a plane in different positions relative to the axis. Traditionally, there are three types of conic section, namely the ellipse, the parabola, and the hyperbola. The circle is a special case of the ellipse and is sometimes called as fourth type of conic section. The isosceles triangle can also be obtained by cutting the cone with a section plane, but it is not considered as the conic section.

85. (b)

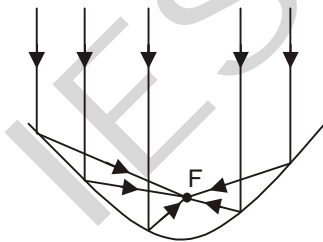
When the cutting plane is passing through the apex and cuts the base of the cone, the curve of intersection is an isosceles triangle. Although the isosceles triangle can also be obtained by cutting the cone with section plane, but it is not considered as the conic section.

86. (c)

The light travelling parallel to the axis of parabolic mirror are reflected to the focal point.

This property is used in solar furnace and solar cooker to produce heat.

If the light is placed at the focus of a parabolic mirror, it will be reflected in rays parallel to the axis. This parabolic mirror reflecting properties are used in telescopes and antennas to collect light and radio waves from the outer space.



87. (c)

Degree 1- line

Degree 2-Conic sections (Circle, Ellipse, Parabola, Hyperbola, Unit hyperbola)

Families of variable degree-Epicycloid, Epispiral, Epitrochoid, Hypocycloid, roulette, spiral, helix

88. (b)

Electric dipole moment mathematical representation

$$p = qL$$

Where q is the charge and L is the distance between them.

89. (a)

$$C = \frac{\epsilon_0 A}{d} = \frac{8.85 \times 10^{-12} A}{2 \times 10^{-3}} = 1$$

$$A = 2.3 \times 10^8 \text{ m}^2$$

90. (c)

$$\text{Inductive reactance } X_L = 2\pi fL$$

$$= 2 \times \pi \times 50 \times 2$$

$$= 628 \Omega$$

91. (a)

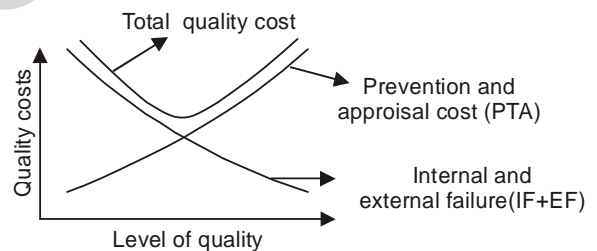
92. (a)

$$\text{Efficiency} = 1 - \frac{\text{losses}}{\text{input}}$$

$$= 1 - \frac{3900}{200 \times 10^3}$$

$$= 0.9805$$

93. (c)



94. (a)

95. (a)

By this kind of posture if one noticed the irregularity then can stop the machine immediately

96. (a)

To keep the driver alert it is important to provide slight band after every few kilometers of straight road.

97. (b)

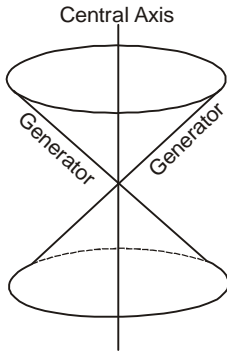
Single stroke vertical capital letters and numerals are the simplest form of letters generally used in practice. The term 'Single stroke' do not mean that the entire letter should be made in one stroke without lifting the pencil. It actually means that the width of the line of the letter should be such as is obtained in one stroke of pencil.

98. (a)

Any imaginary line joining the apex to the circumference of the base circle is called a

generator. Hence,

A cone has an infinite number of generators.



99. (b)

Degree 1- line

Degree 2-Conic sections (Circle, Ellipse, Parabola, Hyperbola, Unit hyperbola)

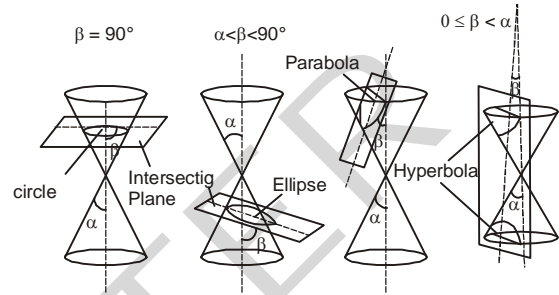
Families of variable degree-Epicycloid, Epispiral, Epitrochoid, Hypocycloid, roulette ,spiral ,helix.

Spiral- If a line rotates in a plane about one of its ends and at the same time , if a point moves along the line continuously in one direction , the curve traced out by the moving point is called a spiral.

100. (c)

The hyperbolic curve graphically represents the Boyle's law i.e. $PV = \text{constant}$.

When the cutting plane cuts both the parts of the double cone, the section is a hyperbola. The cutting plane for the hyperbola should not pass through the apex and its inclination should be less than half of the apex angle i.e. $\beta < \alpha$.



Hence both the statements are correct .

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