



**SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR**  
Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code : SA-II (13A01505)**

**Course & Branch: B.Tech – CE**

**Year & Sem: III-B.Tech & I-Sem**

**Regulation: R13**

**UNIT – I**

**ARCHES**

1. A three hinged parabolic arch a span of 60 meters and rise of 15 meters. The arch carries two concentrated loads of 250 kN and 200 kN at distances of 10 m and 18 m from the left end. It also carries a UDL of 70 kN/m on the right half of the span. Calculate the vertical and horizontal reactions at supports. Also calculate the normal thrusts and radial shear at section 18 m from left support. 10M
2. The equation of the axis of the three hinged arch is  $y=x-x^2/2$ , the origin being the left hand support. The span and rise are 12 m and 3 m respectively. The left half of the arch is loaded with uniformly distributed load of 30 kN/m.  
Evaluate
  - (a) The reaction component at support. 4M
  - (b) Moment, normal thrust and radial shear at a section 3 m from left hand support. 6M
3. A parabolic arch rib, 20 m span and 3 m rise is hinged at the abutments and the crown and carries a point load of 10 kN at 7.5 m from left hand hinge. Calculate the horizontal thrust and bending moment at 7.5 m from right hand hinge. What is the value of greatest bending moment in the arch, and when does it occur? 10M
4. A circular arched rib, span 50 m and rise 10 m is hinged of crown and springing and carrying the vertical loads of 60 and 100 kN at a horizontal distance 12 m and 30 m from left hand support. Find the reaction components at the springing and moment, normal thrust and radial shear at section 10 m left support. 10M
5. A three hinged circular arch hinged at the springing and crown points has a span of 40 meters and central rise of 8 meters. The arch carries a UDL of 20 kN/m over the left half of the span together with a concentrated loads of 100 kN at the right quarter span point. Find the vertical and horizontal reactions at supports. Also calculate the normal thrusts and radial shear at section 10 m from left support. 10M
6. A two hinged circular arch of span 20 m and rise 4 m is loaded with a uniformly distributed load of 100 kN/m over the left half of the span and a concentrated load of 80 kN at the midpoint of the right half of the arch. Calculate the horizontal reaction and normal thrust at a section just to the right of concentrated loads. 10M

7. A two hinged parabolic arch of span 40 m and rise 8 m is subjected to a temperature rise of 22 K. Calculate the maximum bending stress at the crown due to the temperature rise if per 1 K and N/mm<sup>2</sup>. The rib section is symmetrical and 1 m deep. 10M
8. A two hinged parabolic arch of span 30m and rise 6m carries a uniformly distributed load of 20kN/m covering a distance of 12m from left end. Find the horizontal thrust and the reactions at the two supports. Also calculate the maximum hogging moment in the arch. 10M
9. A two hinged parabolic arch of span 20m and rise 4m carries a uniformly distributed load of 20kN/m on the whole span. Find the horizontal thrust and the reactions at the two supports. If now one support yields laterally with respect to the other support by 0.02. What will be the horizontal thrust? Take  $E=200\text{kN/mm}^2$  and  $I_o=1.7\times 10^7\text{ mm}^4$ . 10M
10. a) State Eddy's theorem 2M  
b) Explain rib shortening 2M  
c) Under what conditions will the bending moments in an arch be zero thought 2M  
d) Explain the effect of yielding of support in the case of an arch? 2M  
e) Which of the two arches, viz. circular and parabolic is preferable to carry a uniformly distributed load? Why? 2M



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**UNIT – I**

**ARCHES**

1. The effect of arching a beam is [      ]  
 A) To reduce the B.M throughout      B) To increase the B.M throughout  
 C) Nothing on the B.M throughout      D) All the above
2. A three hinged arch is said to be [      ]  
 A) Statically determinate structure      B) Statically indeterminate structure  
 C) A bent beam      D) none of these
3. In a three hinged arch, the bending moment will be zero [      ]  
 A) At right hinge only      B) at left hinge only  
 C) at both left & right hinges      D) At all the three hinges
4. In a three hinged arch, the third hinge is generally kept at [      ]  
 A) Crown of the arch      B) mid of the crown & left support hinge  
 C) mid of the crown & right support hinge      D) none of these
5. A three hinged arch is loaded with an isolated load 1000kg at a horizontal distance of 2.5m from the crown, 1m above the level of hinges at the supports 10m apart. The horizontal thrust is [      ]  
 A) 1250 kg      B) 125 kg      C) 750 kg      D) 2500 kg
6. If a three hinged parabolic arch carries a uniformly distributed load on its entire span, every section of the arch resists [      ]  
 A)  $\frac{1}{3}$  times the rise of the crown      B)  $\frac{1}{4}$  times the rise of the crown  
 C)  $\frac{1}{2}$  times the rise of the crown      D)  $\frac{3}{4}$  times the rise of the crown

7. A linear arch is subjected only to [     ]
- A) Shear force                                  B) thrust  
C) Bending moment                              D) both a & c
8. An arch with three hinges is a structure [     ]
- A) Statically determinate                       B) Statically indeterminate  
C) Geometrically unstable                      D) none
9. In a three hinged arch, the shear force is usually [     ]
- A) maximum at crown                           B) maximum at springing  
C) maximum at quarter points                 D) varies with slope
10. In a solid arch shear force acts [     ]
- A) Vertically upwards                           B) along the axis of the arch  
C) Perpendicular to the axis of the arch      D) tangentially to the arch
11. An arch may be subjected to [     ]
- A) Shear and axial force                         B) B.M and shear force  
C) B.M and axial force                           D) B.M shear force and thrust
12. A three hinged parabolic arch hinged at crown and springings, has a horizontal span of 4.8m and a central rise of 1m. It carries a UDL of 0.75 tonnes per metre over half left hand span. The horizontal thrust at the support will be [     ]
- A) 10.8 tonnes                                     B) 1.08 tonnes  
C) 1.8 tonnes                                        D) 0.8 tonnes
13. A three hinged arch is generally hinged at its support and [     ]
- A) At one quarter span                           B) at the crown  
C) Anywhere at the rib                            D) none
14. An isolated load  $W$  is acting at a distance 'a' from the left hand support, of a three hinged arch of span '2L' and a rise 'h' hinged at the crown, the horizontal reaction at the support is [     ]
- A)  $\frac{W a}{h}$                     B)  $\frac{W a}{2h}$                     C)  $\frac{2W}{h a}$                     D)  $\frac{2h}{W a}$
15. An isolated load  $W$  is acting at a distance 'a' from the left hand support, of a three hinged arch of span '2L' and a rise 'h' hinged at the crown, the vertical reaction at the support is [     ]

A)  $\frac{Wl^2}{2l}$       B)  $\frac{Wl}{\alpha}$       C)  $\frac{W\alpha}{l}$       D)  $\frac{W\alpha^2}{2l}$

16. If a three hinged parabolic arch (span  $l$ , rise  $h$ ) is carrying a UDL of  $w$ /unit length over the entire span [      ]

- A) Horizontal thrust is  $\frac{wl^2}{8h}$       B) S.F is zero  
 C) B.M is zero      D) all the above

17. The maximum B.M due to an isolated load in a three hinged parabolic arch ( span  $l$ , rise  $h$ ) having one of its hinge at crown, occurs on either side of the crown at a distance [      ]

A)  $\frac{l}{4}$       B)  $\frac{h}{4}$       C)  $\frac{l}{\sqrt{3}}$       D)  $\frac{l}{\sqrt{2}}$

18. Radial shear  $F=$  [      ]

- A)  $V\cos\theta - H\sin\theta$       B)  $V\cos\theta + H\sin\theta$   
 C)  $V\sin\theta - H\cos\theta$       D)  $V\sin\theta + H\cos\theta$

19. Normal thrust  $N=$  [      ]

- A)  $V\cos\theta - H\sin\theta$       B)  $V\cos\theta + H\sin\theta$   
 (C)  $V\sin\theta - H\cos\theta$       D)  $V\sin\theta + H\cos\theta$

20. Arches are curved shape to develop [      ]

- A) Tension      B) compression  
 C) Elasticity      D) none of the above

21. Arches are generally subjected to \_\_\_\_\_ reactive force [      ]

- A) 4      B) 2      C) 3      D) 5

22. Fixed arches can be calculated by using [      ]

- A) castinglounous theorem      B) Elastic centre method  
 C) both (A) & (B)      D) none

23. Arches can be built of \_\_\_\_\_ [      ]

- A) Masonry    B) reinforced concrete      C) steel      D) all the above

24. According to arch geometry the equation of arch ( $y$ ) is [      ]

A)  $\frac{4r}{l}x(l-x)$       B)  $\frac{4r}{l^2}x(l+x)$       C)  $\frac{4r}{l^2}x(l-x)$       D)  $\frac{4r}{l}x(l+x)$

25. In three hinged parabolic arch  $\tan \theta =$  [      ]

A)  $\frac{4r}{l} x(l-x)$       B)  $\frac{4r}{l^2} x(l-2x)$       C)  $\frac{4r}{l} x(l-2x)$       D)  $\frac{4r}{l^2} x(l+2x)$

26. In three hinged circular arches  $R^2 =$  [      ]

A)  $x + (R-r+y)^2$       B)  $x^2 + (R+r+y)^2$       C)  $x^2 + (R-r+y)^2$       D)  $x + (R+r+y)^2$

27. In three hinged circular arches R can be determined from the relationship [      ]

A)  $(2R+r) r = \left(\frac{l}{2}\right)^2$       B)  $(2R-r) r = \left(\frac{l}{2}\right)^2$       C)  $(2R-r) r^2 = \left(\frac{l}{2}\right)^2$       D)  $(2R+r) r^2 = \left(\frac{l}{2}\right)^2$

28. Resultant reactions  $R_A$  and  $R_B$  are [      ]

A)  $\sqrt{V_A^2 + H^2}$  ,  $\sqrt{V_B^2 + H^2}$       B)  $\sqrt{V_A^2 - H^2}$  ,  $\sqrt{V_B^2 - H^2}$

C) both a & b      D) none

29. The change in central rise due to change in temperature  $cc_1 =$  [      ]

A)  $\frac{l^2 + 4r^2}{4r} \propto t$       B)  $\frac{l^2 - 4r^2}{4r} \propto t$       C)  $\frac{l^2 - 4r^2}{4r^2} \propto t$       D) none of these

30. A three hinged arch of span 24m and a central rise of 8m the body of the arch are fabricated with rolled steel sections. Find the change in central rise if the change in temperature is 30°C [      ]

A) 8.36mm      B) 10.36 mm  
C) 9.36 mm      D) 11.36mm

31. According to Castigliano's theorem strain energy  $U =$  [      ]

A)  $\int \frac{M^2}{2EI} dx$       B)  $\int \frac{M^3}{2EI} dx$       C)  $\int \frac{M^2}{2I} dx$       D)  $\int \frac{2M^2}{EI} dx$

32. Due to change in temperature in two hinged arches the horizontal thrust  $H =$  [      ]

A)  $\frac{E \propto TL}{\int y^2 dx}$       B)  $\frac{EI \propto TL}{\int y^2 dx}$       C)  $\frac{EI \propto T}{\int y^2 dx}$       D)  $\frac{EI \propto TL}{\int y^2 dx}$

33. In case of two hinged circular arches  $r =$  [      ]

A)  $R (\sin \alpha + \sin \theta)$       B)  $R (\sin \theta - \sin \alpha)$

C)  $R (\sin \alpha - \sin \theta)$       D)  $R (\sin \theta + \sin \alpha)$

34. A two hinged semicircular arch of radius R carries a concentrated load W at the crown. The horizontal thrust is: [      ]

- A)  $W/2\pi$       B)  $W/\pi$       C)  $2W/2\pi$       D)  $4W/3\pi$

35. A symmetrical parabolic arch of span  $l$  and height  $h$  is hinged at both the supports. The arch carries a udl of  $w$ /unit length along the entire span. Which one of the following is correctly matched?

[      ]

- A) Horizontal thrust:  $wl^2/8h$       B) Bending moment at crown:  $wl^2/8$   
 C) Radial shear at springing:  $[(wl^2/2) - (wl^2/8h)]$   
 D) Vertical reactions at supports:  $wl$

36. A suspension bridge with a two-hinged stiffening girder is \_\_\_\_\_ [      ]

- A) Statically determinate      B) Indeterminate of one degree  
 C) Indeterminate of two degrees      D) A mechanism

37. For a two-hinged arch, if one of the supports settles down vertically, then the horizontal thrust

[      ]

- A) Is increased      B) is decreased      C) remains unchanged      D) becomes zero

38. A fixed arch is a \_\_\_\_\_ structure. [      ]

- A) Determinate      B) indeterminate by 1 degree  
 C) indeterminate by two degrees      D) indeterminate by 3 degree.

39. The vertical distance between springing line to any point in the arch is \_\_\_\_\_. [      ]

- A) Height      B) Rise      C) Fall      D) None

40. A fixed arch with a single hinge at Crown Point is a \_\_\_\_\_ structure [      ]

- A) Determinate      B) indeterminate by 1 degree  
 C) Indeterminate by two degrees      D) indeterminate by 3 degree.

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