BPSC TEST

Date: 09 March, 2019

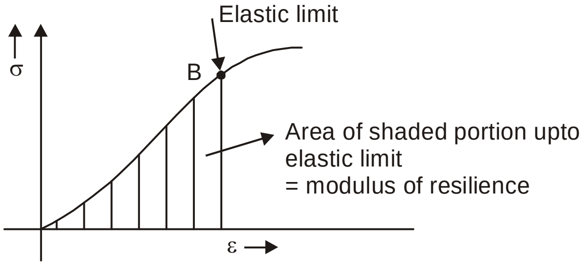
TEST 04 (OBJECTIVE SOLUTION)...

ANSWERS

1.	(b)	11.	(a)	21.	(c)	31.	(d)	41.	(b)
2.	(c)	12.	(b)	22.	(c)	32.	(d)	42.	(b)
3.	(a)	13.	(a)	23.	(d)	33.	(a)	43.	(b)
4.	(b)	14.	(a)	24.	(c)	34.	(d)	44.	(a)
5.	(b)	15.	(d)	25.	(d)	35.	(c)	45.	(d)
6.	(a)	16.	(b)	26.	(d)	36.	(c)	46.	(d)
7.	(c)	17.	(b)	27.	(d)	37.	(b)	47.	(c)
8.	(a)	18.	(c)	28.	(d)	38.	(a)	48.	(c)
9.	(b)	19.	(c)	29.	(a)	39.	(b)	49.	(b)
10.	(a)	20.	(b)	30.	(c)	40.	(d)	50.	(c)

BPSC TEST-04 Solutions
Date: 09 March, 2019

1. (b)



$$\text{Proof resilience} = \frac{1}{2}\times\sigma\times\varepsilon\times\text{volume}$$

$$= \frac{\sigma^2}{2E}\times\text{volume}$$

Whereas, modulus of resilience

$$= \frac{\sigma^2}{2E}$$

2. (c)

We know,

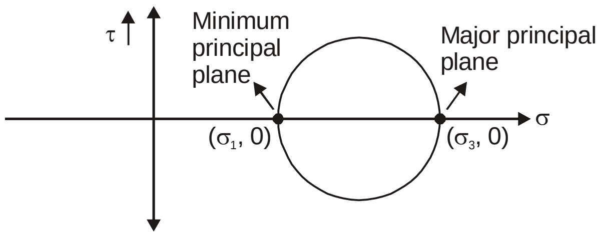
$$G = \frac{E}{2(1+\mu)}$$

$$G = \frac{3G}{2(1+\mu)} \qquad (\because E = 3G)$$

$$1+\mu = 1.5$$

$$\mu = 0.5$$

3. (a)



4. (b)

When a beam is suitably designed such that the extreme fibres are loaded to the maximum permissible stress σ_{max} at every section, by varying the cross-section, it will be known as beam of uniform strength.

5. (b)

$$\text{Euler's crippling load, } F = \frac{n\pi^2 EI}{l^2}$$

Where, n factor accounting for the end conditions

E = modulus of elasticity

l = length of column

I = moment of inertia

Column pivoted at both ends : n = 1

Both ends fixed; n = 4

One end fixed, other end free; n = 0.25

One end fixed, other end hinged; n = 2

6. (a)

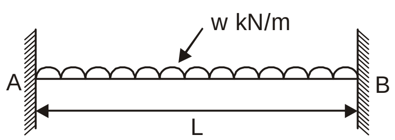
As we know that the maximum stress intensity due to suddenly applied load is 2-times the stress intensity produced by the load of same magnitude applied gradually.

$\therefore$ maximum stress intensity

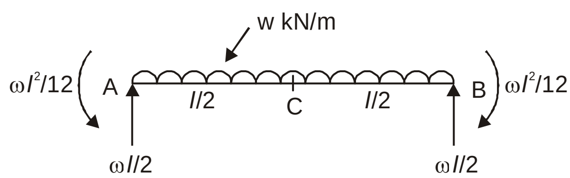
$$= 2\times\frac{200\times1000}{1000}$$

$= 400$ N/mm^2

7. (c)



$$\text{Fixed end moments} = \frac{wL^2}{12}$$



$$\therefore\ M_c = \frac{wL}{2}\times\frac{L}{2}-\frac{wL^2}{12}-\frac{w\times L}{2}\times\frac{L}{4}$$

$= \frac{wL^2}{24}$

8. **(a)**

9. **(b)**

Table : Shape factor for different sections

Shape	Shape factor
Diamond	2
Round	1.70
Rectangle	1.5
I – section	1.4
Tube	1.27

10. **(a)**

Most appropriate theory for brittle materials (cast iron) is maximum principal stress theory,

or, Rankine theory

or, Lame's theory

11. **(a)**

For determinate truss : m = 2j – 3

For indeterminate truss : m > 2j – 3

For unstable truss : m < 2 j – 3

12. **(b)**

Deflection at B = 0

Let reaction at support B = $R_B(\uparrow)$

We have, $\frac{R_B L^3}{3EI} = \frac{ML^2}{2EI}$

$R_B = \frac{3M}{2L}$

$\therefore\ M_A = M - R_B \times L$

(↺)

$= M - \frac{3M}{2}$

$= -\frac{M}{2}$

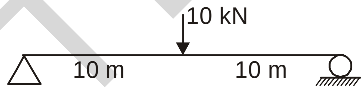
Thus, $M_A = \frac{M}{2}$ (↻)

13. **(a)**

The deflections caused by shear forces and axial forces are neglected in framing the slope deflection equations.

14. **(a)**

The maximum bending moment will occur at mid span when the rolling load is placed at the centre of the girder.



$\therefore$ Maximum bending moment = $10 \times \frac{20}{4}$

= 50 kN-m

15. **(d)**

16. **(b)**

Horizontal thrust in a semi-circular 2 hinged arch subjected to load 'w' at crown = $\frac{w}{\pi}$

Since, $w = \pi$kN

$\therefore\ H = \frac{\pi}{\pi}$kN

= 1 kN

17. **(b)**

Total degree of freedom (DOF)

= 3J – R + additional DOF due to internal hinge

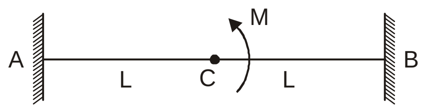
= 3 × 3 – 6 + 4

= 4

However, if axial deformations are neglected.

Then total degree of freedom = 5

18. **(c)**



Due to moment at mid-point there won't be any deflection at centre point C. Thus it can be treated as a roller support. Now the stiffness of AC and CB is $\frac{4EI}{L}$ for both. So moment required

$$= \frac{4EI}{L} + \frac{4EI}{L} = \frac{8EI}{L}$$

19. (c)

Mild : M 20

Moderate : M 25

Sewere : M 30

Very sewere : M 35

Extreme : M 40

20. (b)

Ordinary concrete : M10, M15, M20

Standard concrete : M25, M30, M35, M40, M45, M50, M55.

High-strength concrete : M 60 and above

21. (c)

22. (c)

The design pressure of wind at any height above mean ground level,

$P_2 = 0.6\ V_z^2$

23. (d)

24. (c)

For a simply supported beam

$$I_{eff} = \text{minimum} \begin{cases} l_0 + d \\ \text{or,} \\ l_0 + \frac{a}{2} + \frac{a}{2} \end{cases}$$

where, d = effective depth

a = width of support

$$\therefore\ l_{eff} = \text{minimum} \begin{cases} 4 + 0.6 = 4.6\text{m} \\ \text{or,} \\ 4 + \frac{0.3}{2} + \frac{0.3}{2} = 4.3\text{m} \end{cases}$$

= 4.3 m

25. (d)

26. (d)

27. (d)

Given: V_0 = 20 kN, T_0 = 9 kN-m

b = 0.3 m

Equivalent shear force,

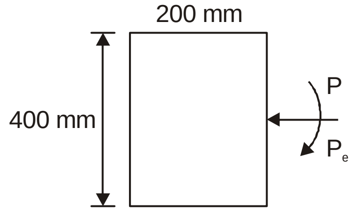
$$V_q = V_u + 1.6\frac{T_u}{b}$$

$$= 20 + 1.6 \times \frac{9}{0.3}$$

= 68 kN

28. (d)

29. (a)



P = 400 kN

e = 0.1 m

$$\therefore\ \sigma_{bottom} = \frac{400 \times 1000}{200 \times 400} + \frac{40 \times 10^6 \times 200}{\frac{200 \times 400^3}{12}}$$

= 12.5 MPa

30. (c)

31. (d)

Since the bolt is M20, thus grade is 4.6

Which means, ultimate strength = 400 MPa.

and yield strength = 0.6 × 400 = 240 MPa

32. (d)

33. (a)

34. (d)

For shop weld, partial safety factor = 1.25

For field weld, partial safety factor = 1.5

35. (c)

Efficiency of joint per pitch length

$$= \frac{\text{tearing strength per pitch length}}{\text{gross strength per pitch length}}$$

$$= \frac{(p-d)\times fy}{p\times fy}$$

$$= \frac{p-d}{p}$$

36. (c)

37. (b)

38. (a)

39. (b)

Co-efficient of uniformity = $\frac{D_{60}}{D_{10}}$

Coefficient of curvature = $\frac{D_{30}^2}{D_{60}\times D_{10}}$

40. (d)

41. (b)

Consistency index (C.I.) = $\frac{\omega_L-\omega}{\omega_L-\omega_p}$

Where, ω_L = liquid limit

ω = natural water content

ω_p = plastic limit

For C.I. = 0, $\omega=\omega_L$

42. (b)

i_c = critical hydraulic gradient = $\frac{G-1}{1+e}$

43. (b)

Given : 45 + $\frac{\phi}{2}=60°$

$\therefore\ \phi=30°$

Now, $100=2C\sqrt{\tan^2\left(45+\frac{\phi}{2}\right)}$

$100=2\times C\times\sqrt{3}$

C = 28.87 kN/m^2

44. (a)

$S_n = \frac{C_m}{\gamma H}$

$= \frac{1}{2\times 5}$

= 0.1

45. (d)

46. (d)

H = $\frac{4C}{\gamma}$

$= \frac{4\times 15}{20}$

= 3m

47. (c)

48. (c)

e = void ratio = $\frac{n}{1-n}$

$$= \frac{\frac{1}{3}}{1-\frac{1}{3}}=0.5$$

$\therefore \omega_s = \frac{e}{G}$

$= \frac{0.5}{2.7}$

$= \left(\frac{5}{27} \times 100\right)\%$

= 18.52%

49. (b)

$T_v = \frac{C_v t}{H^2}$

$T_v \propto t$

$T_v \propto U^2, \therefore t \propto U^2$

$t_2 = t_1 \times \left(\frac{0.6}{0.4}\right)^2 = 178 \times 2.25$

= 400.5 days

$\therefore$ Additional time required = 400.5 – 178

= 222.5 days

50. (c)