3rd Semester Diploma Engineering Examination, 2019

Subject : Strength of Material **Full Marks : 80**

Subject Code : 12306

Time : 3 Hours **Pass Marks : 26**

Answer in your own words.

Answer five *questions in which* Question No. 1 *is compulsory and answer* any four *from rest questions.*

All questions carry equal marks.

1. Choose one correct answer: 2×8=16

(i) The ratio of lateral strain to the linear strain is called

(a) Modulus of elasticity (b) Modulus of rigidity

(c) Bulk modulus (d) Poisson's ratio

(ii) The bulk modulus (k) of a body is equal to

(a) $\frac{mE}{3(m-2)}$ (b) $\frac{mE}{3(m+2)}$

(c) $\frac{mE}{2(m-2)}$ (d) $\frac{mE}{2(m+2)}$

(iii) When a body is subjected to a direct stress (σ) in one plane, then normal stress on an oblique section of body inclined at an angle to the normal of the section is equal to

(a) $\sigma\sin\theta$ (b) $\sigma\cos\theta$

(c) $\sigma\sin^2\theta$ (d) $\sigma\cos^2\theta$

(iv) The moment of inertia of circular section of diameter (d) is given by the relation

(a) $\frac{\pi d^2}{16}$ (b) $\frac{\pi d^4}{32}$

(c) $\frac{\pi d^4}{64}$ (d) $\frac{\pi d^4}{96}$

(v) The bending moment at the free end of a cantilever beam carrying any type of load is

(a) zero (b) minimum

(c) maximum (d) equal to the load

(vi) The bending equation is

(a) $\frac{M}{I}=\frac{\sigma}{y}=\frac{E}{R}$ (b) $\frac{T}{J}=\frac{\tau}{r}=\frac{C\theta}{l}$

(c) $\frac{M}{y}=\frac{\sigma}{I}=\frac{E}{R}$ (d) $\frac{T}{r}=\frac{\tau}{r}=\frac{C\theta}{l}$

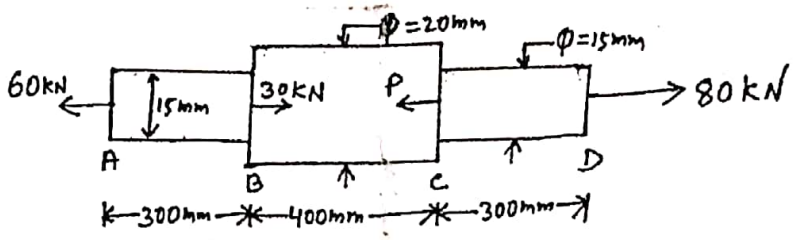
(vii) The point of contraflexure is a point where

(a) shear force changes sign
(b) bending moment changes sign
(c) shear force is maximum
(d) bending moment is maximum

(viii) The property of a material due to which it breaks with little permanent distortion is called

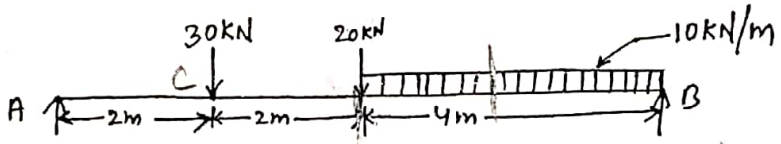
(a) Brittleness
(b) Ductility
(c) Malleability
(d) Plasticity

2. (a) Find the force 'P' acting at C in the bar shown in fig. Find the extension of the bar if $E = 2\times10^5$ MPa.



(b) An aluminium alloy bar, fixed at its both ends is heated through 20K. Find the stress developed in the bar. Take modulus of elasticity and coefficient of linear expansion for the bar as 80 GPa and 24×10^{-6}/K respectively. 8+8=16

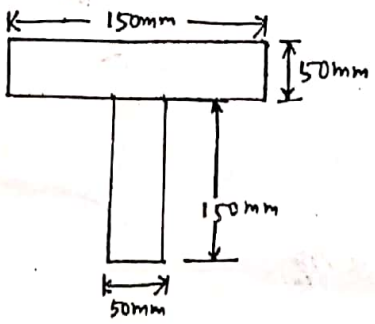
3. Draw the SFD and BMD for the beam as shown in fig. 16



4. (a) Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in solid shaft of 100 mm diameter, 10m long, transmitting 11·2 kW at 150 rpm. Take $G = 82$ kN/mm^2.

(b) What is the assumption for circular shaft subjected to Torsion? 12+4=16

5. (a) Find the moment of Inertia of a T-section with flange as 150mm × 50mm and web as 150mm × 50mm about X-X axis through the centre of gravity of the section.



(b) What is the assumption of simple theory of bending? 12+4=16

6. (a) A wooden bar is subjected to a tensile stress of 5MPa. What will be the values of normal and shear stresses across a section, which makes an angle of 25° with the direction of the tensile stress.

(b) Draw stress-strain curve for Ductile material and explain. 8+8=16

7. Write short notes on *any two*: 8×2=16

(i) Ductility, Hardness, Creep, Fatigue

(ii) Types of load and types of Beam

(iii) Axial load, eccentric load, shear stress, shear strain

Booklet No - 115046

301
ALL

Jharkhand University of Technology, Ranchi

3rd Semester Diploma Engineering Examination, December 2019

Subject : Engineering Mathematics-III **Subject Code : 301**

Time : 3 Hours **Full Marks : 80**

Pass Marks : 26

Answer in your own words.

Answer five *questions in which* Question No. 1 *is compulsory and answer* any four *from rest questions.*

All *questions carry equal marks.*

1. Choose the correct answer:

(i) $\int cosecx\, dx$ is equal to

(a) $\log \tan \frac{x}{2} + c$ (b) $\log \cot \frac{x}{2} + c$

(c) $\log \sin \frac{x}{2} + c$ (d) None of these

(ii) The value of $\int_{-1}^{1} \frac{dx}{1+x^2}$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{6}$ (d) None of these

(iii) The area enclosed by the curve $y = 4x$ and $x = 3$ and $x = 5$ is

(a) $\frac{16}{3}$ sq. unit (b) 32 sq. unit

(c) $\frac{64}{3}$ sq. unit (d) None of these

(iv) The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^3\right] = 2\left(\frac{d^2y}{dx^2}\right)$ is respectively equal to

(a) 2 and 3 (b) 3 and 2

(c) 3 and 1 (d) None of these

(v) If the probability of defective bolt is 0·1 then Standard Deviation in a total of 400 bolt is equal to

(a) $2\sqrt{5}$ (b) $2\sqrt{10}$

(c) $\sqrt{10}$ (d) None of these

(vi) The value of $\int e^x \left(\frac{1}{x} + \log e^x\right) dx$ will be

(a) $\frac{1}{x} e^x$ (b) $e^x \log e^x$

(c) $e^x \log a^x$ (d) None of these

(vii) The solution of the function $f(x) = 0$, using Newton-Raphson method fails, if $f'(x)$ is near or equal to

(a) finite (b) zero

(c) real (d) None of these

(viii) The Laplace transform of the function e^{at} is

(a) $\frac{1}{s-a}, s > a$ (b) $\frac{1}{s+a}$

(c) $\frac{\lfloor n}{s}$ (d) None of these

2. Solve *any two* of the following integrals:

(a) $\int \frac{(3x-4)}{\sqrt{x-2}} dx$

(b) $\int \frac{1}{1+\sin 2x} dx$

(c) $\int \frac{x \tan^{-1} x^2}{1+x^4} dx$

3. Solve *any two*:

(a) $\int x^2 \cos 2x \, dx$

(b) $\int \frac{dx}{x^2-4x+5}$

(c) $\int \frac{x}{(x-1)(x^2+4)} dx$

4. (a) $\int_0^{\frac{\pi}{2}} \log(\cos x) dx$

(b) Find the area of circle $x^2 + y^2 = 9$ by integration method.

5. (a) Form the differential equation whose general solution is $y = Ae^{2x} + Be^{-2x}$.

(b) Solve $\cos(x+y)dy = dx$.

6. (a) Solve $\frac{dy}{dx} + y\cot x = \cos x$

(b) $x(y-x)\frac{dy}{dx} = y(x+y)$ (16)

7. (a) Using Newton-Raphson find the root that lies in (0, 1) of the equation $x^3 - 6x + 4 = 0$ correct to 3 decimal places.

(b) Estimate from the following table the number of students who obtained marks between 40 and 45:

Marks	30–40	40–50	50–60	60–70	70–80
No. of students	31	42	51	35	31

8. (a) Find the Laplace transform of $\cos^2 t$.

(b) Find a Fourier series to represent $x - x^2$ from $x = -\pi$ to π and show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots$

9. (a) A problem in Mathematics is given to three students Ram, Mohan and Sohan whose chances of solving it are $\frac{1}{3}, \frac{1}{4}$ and $\frac{2}{3}$ respectively. What is the probability that the problem will be solved if they try independently.

(b) The probability of any ship of a company being destroyed on certain voyage is 0·03. The company owns 8 ships for the voyage. What is the probability of

(i) losing one ship.

(ii) losing at the most 2 ships.

10. (a) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using

(i) Trapezoidal rule choosing step length 0·25 in each

(b) Using Gauss-Seidel method solve the following equations:

$$10x - 2y - z = 3$$
$$-2x + 10y - z = 15$$
$$-x - y + 10z = 27$$