B.Printing Engineering Examination, 2018

(1st Year, 2nd Semester)

STRENGTH OF MATERIALS

Time:3 hrs.

Full marks : 100

(Attempt any one from (a) and (b) in Question-1)

1. (a)(i) **Define:** Resilience, Proof resilience and modulus of resilience. (4)

(ii) Show that the **strain energy** stored in a body when the load is **applied** gradually is Given by : $U = (\sigma^2/2E) \times V$

where, σ= stress in the elastic limit, U= strain energy stored in the body, V= volume of the body, E= Young's modulus. (6)

(b) A metallic bar **250mm X 80mm X 30mm** is subjected to a force of **20kN(tensile),30kN(tensile)** and **15kN(tensile)** along **x,y and z directions** respectively. **Determine the change in volume** of the block.

Given: $E = 2X10^5 N/mm^2$ and poisson's ratio(μ) = 0.25. (10)

(Attempt any one from (a) and (b) in Question-2)

2. (a)(i) Derive the relation for a circular shaft when subjected to torsion as

Given: $T/J = \tau/R = C\theta/L$ where, T= torque transmitted, J= polar moment of inertia, τ= maximum shear stress, C= modulus of rigidity, R= radius of shaft, θ= angle of twist, L= length of shaft. (8)

(ii)A solid cylindrical shaft is to transmit **300kN power** at **100 rpm**.

(I)If the shear stress is not exceed **80N/mm²,** find the **diameter** of the shaft.

(II) what **percent saving in weight** would be obtained if the shaft is replaced by a hollow one **whose internal diameter equal to 0.6 of the external diameter,** the length, the material and maximum shear stress being same.

(b)(i) **Define** helical springs. Name the two important types of helical springs.

helical springs.

(ii) Show that the maximum shear stress induced in the wire of a close-coiled helical spring is given by : $\tau s = 16.W.R / \pi.d^3$ where, τs = maximum stress induced in the wire, **W**= axial load on spring , **R**= mean diameter of the spring coil, **d**= diameter of the spring wire.

(iii) A closed coiled helical spring made of **ϕ10mm diameter** steel wire has **15 coils** of **ϕ100mm** mean diameter. The spring is subjected to an axial load of **100 N.** **calculate** : (I) the maximum shear stress induced;
(II) the deflection;
(III) stiffness of the spring.

(3

(Attempt any two from (a),(b) and (c) in Question-3)

3 (a) Draw the **shear force and bending moment diagrams** of a simple supported beam Carrying a **uniformly varying load** from **zero** at one end to 'ω' **per unit length** at the **Other end**. Also calculate the **maximum B.M** for the beam.

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(b) A cantilever of length **2meters** as shown in **FIGURE-1**, carries a **uniformly distributed Load 1kN/m** run over a length of **1.5m** from the free end.

Draw : **(I)** the shear force diagram **(II)** the bending moment diagram. (10)

(c) **Draw** the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of **4.5kN/m** over the entire length as shown in **FIGURE-2.** Also locate the point of contraflexure. (10)

(Attempt any two from (a), (b) and (c) in Question-4)

4.(a) (i) **Explain the terms** : Neutral axis, Section modulus and Moment of resistance. (6)

(ii) Find the **section modulus** for : (I) **hollow rectangular section**
(II) **circular section.** (3+3)

(iii) A rectangular beam **200mm deep and 300mm wide** is simply supported over a span **of 8metres.** What uniformly distributed load 'ω' **per metre** the beam may carry, if the bending stress is not to exceeded **120 N/mm^2.** (3+5) (8)

(b) (i) Prove the relation **$M = E.I.(d^2y/dx^2)$**, where **M**= bending moment, **E**= young's modulus, **I**= moment of inertia, **y**= deflection, **x**= length of the beam at any position. (7)

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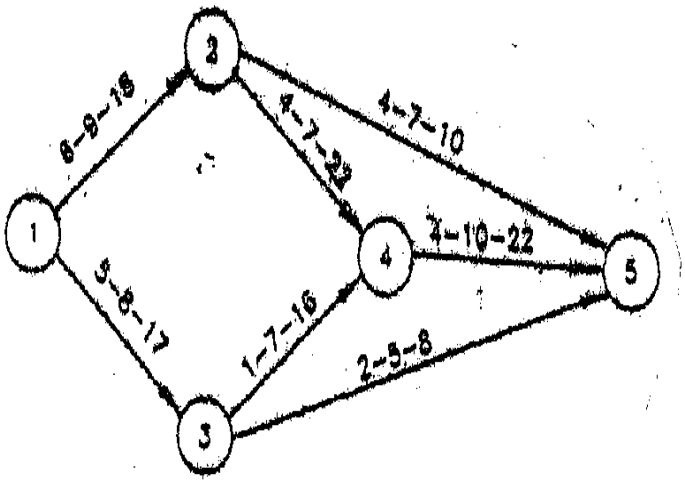
deviation is 0.18. Do these figures equation for any action by any one? (4+6)

Attempt any one from (a), (b) and (c) in Question-4.

I. (a) State the characteristics of individual and group behaviour. (10)

(b) What are the assumptions of McGregor's Theory 'X' and Theory 'Y'; which one is applicable in INDIA? (10)

(c) Write an essay on "Behavioural Science". (10)



FIGURE

(ii) A hollow cylinder drum ϕ**600mm** diameter, **3metres** long has a thickness of **10mm**. If the drum is subjected to an internal air pressure of **3N/mm², determine the increase in the volume of the drum.**

Given : $E = 2 \times 10^5$ **N/mm²** and poisson's ratio(μ) = **0.3.** (7)

(b) **Show** that the circumferential strain(e_1) and longitudinal strain(e_2), Produced in a thin cylinder when subjected to internal fluid pressure (p) are given by: $e_1 = p.d / 4tE(2-\mu)$

And

$e_2 = p.d/4t.E(1-2\mu)$

where, **p**=internal fluid pressure, **d**= internal diameter of the thin Cylinder, **t**= thickness of thin cylinder, μ= Poisson's ratio. (10)

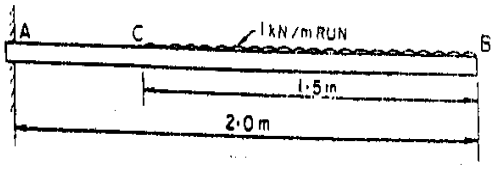


FIGURE- 1.

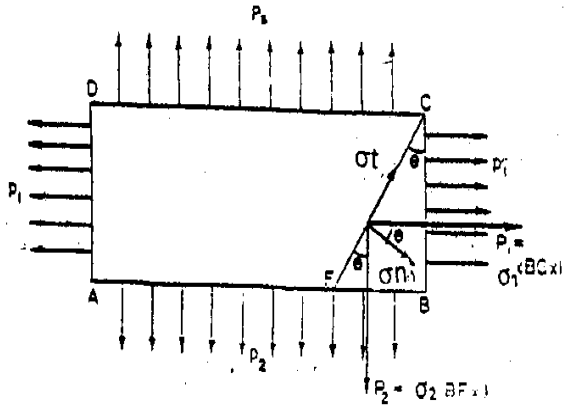
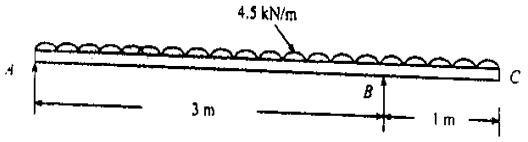


FIGURE -3.



FIFGURE -2.

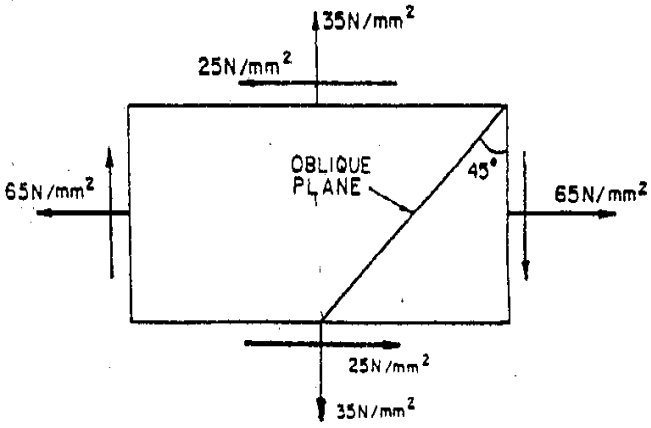


FIGURE – 4.