SAPTHAGIRI
College of Engineering
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SAPTHAGIRI COLLEGE OF ENGINEERING
Department of Civil Engineering
Internal Assessment Test –III

Subject:Strength of Materials		
Semester/Section:3rd SEM	Sub Code: 17CV32	Name of the coarse instructor.
Duration: 90 Minutes	Max Marks: 30	PROF.GEETHA.T.S
	Date: 22.11.2018	Time: 1.00PM to 2.30 PM

Note: **Answer any two full questions, choosing one from each module**

Question No.	Questions	Marks	BLT	CO's
	Module 4			
1 a.	Differentiate between long column and short column.	5	L2	CO4
b.	Derive an expression of hoop stress and longitudinal stress of thin walled pressure vessels.	10	L2	CO4
	OR			
2 a.	Differentiate between thin and thick cylinders.	5	L2	CO4
b.	Derive Lame's equation for radial and hoop stresses for thick cylinder subjected to internal and external fluid pressure.	10	L2	CO4
	Module 5			
3 a.	Derive the Euler's equation for buckling load on an elastic column with both ends pinned.	7	L2	CO5
b.	A hallow rectangular cast iron column has external dimensions of 150mmX200mm and thickness of 25mm. The column is 5m long with both ends fixed. If E for column material is 120GPa, compute the critical load on this column by Euler's formula. ~~Compare the value of load obtained by Rankine's formula. Take yield stress 500MPa and α=1/1600.~~	8	L4	CO5
	OR			
4 a.	Derive the Euler's equation for buckling load on an elastic column with both ends fixed.	7	L2	CO5
b.	A hallow cylindrical cast iron column is 4m long both ends fixed. Design the column to carry axial load of 250KN. Use Rankine's formula. The internal diameter may be taken as 0.8 times the external diameter. Take E=550N/mm^2. α=1/1600	8	L4	CO5

CO4-Students should be able to understand the analysis of thin and thick cylinders.

CO5-Students should be able to understand the basic concept of analysis and design of structural elements such as columns and struts.

Signature of coarse Instructor

Principal
Sapthagiri College of Engineering
Chikkasandra, Hesaraghatta Road,
Bangalore-560 057

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SAPTHAGIRI COLLEGE OF ENGINEERING, BANGALORE-57

DEPARTMENT OF CIVIL ENGINEERING

SCHEME & SOLUTIONS

Semester: III
Subject : Strength of Materials
Duration: 90 minutes
Staff Name: Geetha.T.S

Date: 22.11.2018
Subject code: 17CV32
Marks: 30
Signature: Gtha

INTERNAL TEST

Qs No	Solutions		Marks Allocated
	Short column	Long column	
1.a	$\frac{l_{eff}}{b} \leq 12$	$\frac{l_{eff}}{b} > 12$	
	Buckling tendency low	Buckling tendency high	5M
	Failure by crushing	Failure by buckling	
	Load carrying capacity high	Load carrying capacity low	
b	Fig $P = p.d.L$ $T = \sigma_c \times 2(tL)$ $\sigma_c = \frac{pd}{2t}$	$P_L = p\,\pi d^2/4$ $P_R = \sigma_l \pi . d t$ $\sigma_l = \frac{pd}{4t}$	10M
	$\boxed{\sigma_c = 2\sigma_l}$		
2 a.	$- t < \frac{1}{10}^{th} r_i$	$- t \geq \frac{1}{10}^{th} r_i$	
	- radial shear stress neglected	- radial shear stress considered	
	- hoop stress uniformly distributed	- varies parabolically	5M
	- tires, gas storage tanks	- Gun Barrels	

SAPTHAGIRI COLLEGE OF ENGINEERING, BANAGLORE – 57

DEPARTMENT OF CIVIL ENGINEERING

SCHEME AND SOLUTIONS

SEMESTER :

SUBJECT:

DURATION:

STAFF NAME:

DATE:

SUBJECT CODE:

MARKS:

SIGNATURE:

INTERNAL TEST

Qs. No.	Solutions	Marks Allocated
b.	$I = 71.87 \times 10^6$ $P = \frac{4\pi^2 EI}{L^2} = 13.6 \times 10^6$ N (Eulers) – 4m $P = \frac{\alpha A}{1+\alpha(\frac{l}{k})^2} = 1.75 \times 10^6$ N (Rankines) – 4m $P_{Eulers} > P_{Rankines}$.	8M
4a	BM, $M = -(P \times y)$ net Moment $= M + M_0$ $M + M_0 = EI \frac{d^2y}{dx^2}$ $-Py + M_0 = EI \frac{d^2y}{dx^2}$ $\frac{d^2y}{dx^2} + \frac{Py}{EI} = \frac{M_0}{EI}$ $y = C_1 \cos x\sqrt{\frac{P}{EI}} + C_2 \sin x\sqrt{\frac{P}{EI}} + \frac{M_0}{P}$ when $x = 0, y = 0$ — $C_1 = -\frac{M_0}{P}$ $x = 0 \; \frac{dy}{dx} = 0$ — $C_2 = 0$	

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SAPTHAGIRI COLLEGE OF ENGINEERING

Department of Engineering Mathematics

Internal Assessment –III

Subject: Engineering Mathematics - III
Semester/Section: III SEM
Duration: 1.5 hours

Sub Code: 17MAT31
Max Marks: 30
Date: 22-11-2018

Note: Answer any two full questions, choosing one from each module

Question No.	Questions	Marks	BLT	CO's
	Module-1			
1 a.	Using Newton-Raphson method find the real root of $x\log_{10}x = 1.2$ correct to three decimal places.	5	L1 & L2	CO5
b.	Find f(1.4) from the following table x: 1, 2, 3, 4, 5 F(x): 10, 26, 58, 112, 194	5	L1 & L2	CO5
c.	Find the equation of the cubic curve passing through the points (4, -43),(7, 83),(9,327),(12,1053) using Newton divided difference formula and find F(10).	5	L1 & L2	CO5
	OR			
2 a.	Find the root of the equation $\cos(x) = xe^x$ using Regula-Falsi method correct to four decimal places, in the interval (0, 1).	5	L1 & L2	CO5
b.	Using Lagrange's Interpolation formula find a polynomial which passes through the points (0, -1),(1, 0),(3, 6),(4, 12).	5	L1 & L2	CO5
c.	Using Simpson $(3/8)^{th}$ rule evaluate $\int_0^{\pi/2} e^{\sin x}\,dx$ by dividing the interval into six equal parts.	5	L1 & L2	CO5
	Module-2			
3 a.	If $\vec{F} = 3xy\hat{i} - y^2\hat{j}$, *evaluate* $\int_c \vec{F}.d\vec{r}$ where c is arc of parabola $y = 2x^2$ from (0,0) to (1, 2).	5	L2	CO6
b.	Apply Green's theorem to evaluate $\oint_c (2x^2 - y^2)dx + (x^2 + y^2)dy$, where c is the boundary of the x-axis and the upper of the circle $x^2 + y^2 = a^2$	5	L2	CO6
c.	Verify stokes theorem for $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ taken around the rectangle by the lines $x = \pm a$, $y = 0$ and $y = b$	5	L2	CO6
	OR			
4 a.	Find the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ along the straight line from (0,0,0) to (2,1,3).	5	L2	CO6

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DEPARTMENT OF MATHEMATICS

SCHEME & SOLUTION

Sem. & Sec.: III - Sem

Academic Year:

Date: 22/11/2018

Subject: Engg Mathematics - III

Subject Code: 17MAT31

Duration: 1.5 hrs

Max. Marks: 30

INTERNAL ASSESSMENT TEST - III

Q. No.	Solutions	Marks Allocated
1) a)	$f(x) = x\log_{10}x - 1.2$ Initial app^n $x_0 = 2$ $f'(x) = 0.4342 + \log_{10}x$ formula $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ — ① $x_1 = x_0 - \frac{f(x_0)}{f'(x_0)} = 2 + \frac{0.5979}{0.7352} = 2.8132$ — ① $x_2 = 2.7412$ $x_3 = 2.74064$, $x_4 = 2.7406$ — ③	5
b)	Newton forward interpolation formula Table I Row value — ② x | $f(x)$ | Δy | $\Delta^2 y$ | $\Delta^3 y$ | $\Delta^4 y$ 1 | 10 | 16 | 16 | 6 | 0 $f(x) = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_0 + \frac{p(p-1)(p-2)}{3!}\Delta^3 y_0$ — ① $p = \frac{1.4-1}{1} = 0.4$ Substitution is $f(1.4) = 14.864$ — ②	5
c)	Table I Row x | $f(x)$ | $\Delta f(x)$ | $\Delta^2 f(x)$ | $\Delta^3 f(x)$ — ② 4 | -43 | 42 | 16 | 1 formula ① $f(x) = f(x_0) + (x-x_0)\Delta f(x) + (x-x_0)(x-x_1)\Delta^2 f(x)$ $f(x) = x^3 - 4x^2 - 7x - 15$ $f(10) = 515$ — ②	5

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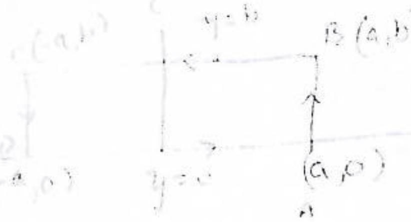
$\oint \vec{F} \cdot d\vec{r} = \iint_S (\nabla \times \vec{F}) \cdot \hat{n}\, ds$ —— (1)



L.H.S $\oint_C = \int_{ABCD} = \int_{AB} + \int_{BC} + \int_{CD} + \int_{DA} =$

$= -ab^2 - \frac{2a^3}{3} - 2ab^2 - ab^2 + \frac{2a^3}{3}$

$= -4ab^2$ —— (2)

$\nabla \times F = -4y\hat{k}$ R.H.S $= \int_{-a}^{a} \int_{y=0}^{b} (-4y\hat{k}) \cdot \hat{k}\, dy\, dx = -b^2 \int_{-a}^{a} dx = -4ab^2$ —— (2)

5

line eq^n $\frac{x}{2} = \frac{y}{1} = \frac{z}{3}$

Writing in parametric form or in terms of one variable —— (1)

$y = x/2$, $z = \frac{3x}{2}$ $\int_C 3x^2 dx + (2xz - y)\, dy + z\, dz$ —— (2)

$dy = dx/2$, $dz = \frac{3dx}{2}$

$\int_0^1 3x^2 dx + \left[2x\left(\frac{3x}{2}\right) - \frac{x}{2}\right]\frac{dx}{2} + \frac{3x}{2}\left(\frac{3dx}{2}\right) = 16$ —— (2)

5

$\ldots = xy + y^2$ $G = x^2$

$\oint = \int_{C_1} + \int_{C_2} = \int_0^1 (3x^3 + x^4)\, dx + \int_1^0 3x^2 dx$ —— (3)

L.H.S $= \frac{19}{20} - 1 = -\frac{1}{20}$

R.H.S $\iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right) dx\, dy = \int_{x=0}^{1} \int_{y=x^2}^{x} (x - 2y)\, dy\, dx$ —— (2)

$= -\frac{1}{20}$

5

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17ME34

SAPTHAGIRI COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST INTERNAL ASSESSMENT - ODD SEMESTER 2018-19

MECHANICS OF MATERIALS

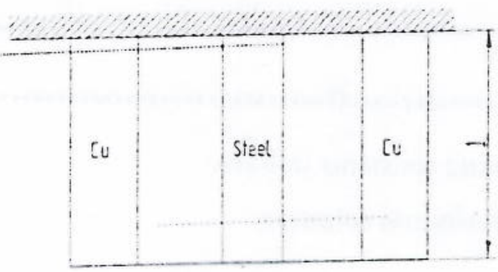
Sem & Sec: 3rd 'A' & 'B'
Time: 90 Min

Date: 21-09-2018
Max. Marks: 30

Note: Answer any one full question from each Module

Q. NO.		MODULE - I	MARKS	RBT LEVEL	CO's
1.	a.	Define (i) Hooke's Law (ii) Poisson's Ratio (iii) Bulk Modulus (iv) Rigidity Modulus	-04-	L1	CO1
	b.	Derive an expression for elongation of tapered bar with rectangular cross-section	-11-	L1, L2, L3	CO1

OR

2.	a.	Derive an expression for establishing the relationship between young's modulus and rigidity modulus.	-08-	L1, L2, L3	CO1
	b.	A composite bar consisting of three rods, each of $1m$ length and $500\ mm^2$ in cross-section as shown in fig. If the temperature rise in 40°C, estimate the load carried by each rod and elongation. Take $E_s = 200\ GN/m^2$, $E_c = 100\ GN/m^2$, $\alpha s = 1.2 \times 10^{-5}/°C$, $\alpha c = 1.8 \times 10^{-5}/°C$.  All Dimensions are in meter	-07-	L1, L2, L3	CO1

Q. NO.		MODULE - II	MARKS	RBT LEVEL	CO's
3.	a.	For the round bar shown in fig., determine the magnitude of force 'P' such that net deformation is $1mm$. Take $E_s = 200\ GPa$ & $E_a = 70\ GPa$.	-07-	L1, L2, L3	CO1

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Sapthagiri College of Engineering, Department of Mechanical Engineering, Bangaluru-560057

Scheme and Solution

Sub Name: Mechanical Materials Code: 17ME34 Class and Section: III A & B Date: 21/09/18

Question Number	Solution	Marks Allocated
	MODULE 1	
1. a.	Each Definition → 1M	4 M
b.	SKETCH →	2M
	To write width of element $b_x = b_1 - \left(\frac{b_1 - b_2}{L}\right)x$ →	1M
	Area of the element $A_x = b_x \times t$ →	1M
	Elongation of the element $\delta L = \frac{P \cdot dx}{(b_1 - kx) t E}$ →	2M
	Total Elongation $\delta L = \int_0^L \delta L = \int_0^L \frac{P \cdot dx}{(b_1 - kx) t E}$ →	2M
	To write $\boxed{\delta L = \frac{P \times L}{t E (b_1 - b_2)} \log_e\left(\frac{b_1}{b_2}\right)}$ →	3M
		11 M
	OR	
2. a.	SKETCH →	2M
	To write Strain in diagonal $DB = \frac{B'E}{DB}$ →	1M
	$DB = AB \times \sqrt{2}$, $B'E = \frac{BB'}{\sqrt{2}}$ →	1M
	Strain in diagonal $DB = \frac{BB'}{\sqrt{2}} \cdot \frac{1}{AB\sqrt{2}} = \frac{1}{2} \tan\phi$	
	Strain in diagonal $DB = \frac{\phi}{2}$ →	1M
	Strain in diagonal $DB = \frac{\tau}{E}\left(1 + \frac{1}{m}\right)$ →	2M
	$\boxed{E = 2G\left(1 + \frac{1}{m}\right)}$ →	1M
		08M

Sapthagiri College of Engineering, Department of Mechanical Engineering, Bangalore 560057

Scheme and Solution

Sub Name: MOM Code: 17ME34 Class and Section: III ME B Date: 21/09/18

Question Number	Solution	Marks Allocated
	Continued	
3b.	$\frac{\tau_s}{R} = \frac{\tau}{r}$ →	1M
	To find $dT = \frac{2\pi}{R}\tau_s \cdot r^3 \cdot dr$ →	2M
	$T = \frac{\tau_s}{R} \times J$	
	$\boxed{\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}}$ →	2M
		08M
	OR	
4 a.	$\epsilon_x = \frac{\sigma_x}{E} - \frac{\sigma_y}{mE} - \frac{\sigma_z}{mE}$ $\epsilon_y = \frac{\sigma_y}{E} - \frac{\sigma_z}{mE} - \frac{\sigma_x}{mE}$ $\epsilon_z = \frac{\sigma_z}{E} - \frac{\sigma_x}{mE} - \frac{\sigma_y}{mE}$ →	3M
	$\epsilon_v = \frac{(\sigma_x + \sigma_y + \sigma_z)}{E}\left\{1 - \frac{2}{m}\right\}$ →	3M
	→	1M
	$\sigma_x + \sigma_y + \sigma_z = 0.$ $\epsilon_v = \frac{\delta v}{v} \Rightarrow \delta V = 0$ →	1M
	$\epsilon_v = 0.$	08M
b.	To find $T_{mean} = 3819.70$ N-m →	2M
	$T_{max} = 1.25\,T_{mean}$ $= 4774.65$ N-m →	1M
	$\frac{T}{J} = \frac{\tau}{r} \Rightarrow d = 0.074$ m →	2M
	$\frac{T}{J} = \frac{G\theta}{l} \Rightarrow \theta = 0.0811$ rad. → $\theta = 4.65°$	2M
		07M