Code No: RT21032 **R13** SET - 1

II B. Tech I Semester Supplementary Examinations, June - 2015
MECHANICS OF SOLIDS
(Com. to ME, AME, AE, MTE)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART–A

1	a)	What is elastic limit and elasticity?	4
	b)	Draw the S.F.D and B.M.D of a cantilever carrying point load at the free end.	4
	c)	Write the assumptions of simple bending.	3
	d)	A cantilever of length 2.6m carries a u.d.l of 16.5 kN/m length over entire length. If moment of inertia of the beam is 7.90 x 10^7 mm^4 and value of E = 2 × 10^5 N/mm^2, determine the deflection at the free end.	4
	e)	A spherical vessel 1.5m diameter is subjected to an internal pressure of 2 N/mm^2.Find the thickness of the plate required if maximum stress is not to exceed 150N/mm^2.	3
	f)	Define the terms Torsion and torsional rigidity.	4

PART–B

2	a)	Derive an expression for the major and minor principle stresses on an oblique plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by shear stresses.	12M
	b)	A steel rod which tapers uniformly from 5cm diameter to 3cm diameter in length of 50cm,is subjected to an axial load of 6000N.If E = 2 × 10^5 N/mm^2, find the extension of the rod.	4M
3	a)	A cantilever of length 4m carries a gradually varying load, zero at the free end to 2kN/m at the fixed end .Draw the S.F.D and B.M.D for the cantilever.	8M
	b)	Derive the relation between loading, shear force and bending moment	8M
4	a)	A Cantilever of length 2m fails when a load of 2kN is applied at the free end. If the section of the beam is 40m x 60m,find the stress at the failure.	8M
	b	Show that for a rectangular section the maximum shear stress is 1.5 times the average stress.	8M
5	a)	A cantilever beam AB of length 6m carries a point load of 100kN at free end and another point load 100kN at 3m from the free end.If E =$10^5$$N/mm^2$ and I =10^8 mm^4 for the cantilever then determine the slope and deflection at the free end by Moment area method.	12M
	b)	Write in brief about double integration method.	4M
6		Derive Lami's equation of thick cylinders.	16M
7	a)	Derive the expression for the crippling load when both ends of the column are hinged.	10M
	b)	Define polar modulus .Derive polar modulus for solid shaft and hollow shaft.	6M
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Code No: RT21032 **R13** SET - 2

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) What is tangential stress and longitudinal stress?

b) Draw the S.F.D and B.M.D of a cantilever carrying u.d.l throughout.

c) Define section modulus. Derive for rectangular section.

d) A cantilever of length 3.6m carries a u.d.l of 12.5 kN/m length over entire length. If moment of inertia of the beam is 7.90 x 10^7 mm^4 and value of E = 2 × 10^5 N/mm^2, determine the deflection at the free end.

e) A spherical vessel 2.0m diameter is subjected to an internal pressure of 4 N/mm^2. Find the thickness of the plate required if maximum stress is not to exceed 180N/mm^2.

f) Write the limitations of Euler's formula.

PART -B

2	a)	Derive an expression for the stresses on an oblique plane of a rectangular body,when the body is subjected simple shear stresses.	12M
	b)	A steel rod which tapers uniformly from 6cm diameter to 4cm diameter in length of 60cm,is subjected to an axial load of 7000N.If E = 2 X 10^5 N/mm^2, find the extension of the rod.	4M
3	a)	A cantilever of length 3m carries a gradually varying load, zero at the free end to 1kN/m at the fixed end .Draw the S.F.D and B.M.D for the cantilever.	8M
	b)	Derive the relation between loading, shear force and bending moment	8M
4		Derive the equation M/I = f/y = E/R	16M
5	a)	A cantilever beam AB of length 4m carries a point load of 100kN at free end and another point load 100kN at 2m from the free end. If E =10^5N/mm^2 and I =10^8 mm^4 for the cantilever then determine the slope and deflection at the free end by Moment area method.	12M
	b)	Write in brief about Macualay's method.	4M
6	a)	A cylindrical vessel is 1.6m diameter and 5m long is closed at ends by rivets. It is subjected to an internal pressure of 4N/mm^2.If the maximum principal stress is not to exceed 120 N/mm^2, find the thickness of the shell. Assume E = 2 x 10^5 N/mm^2 and Poisson's ratio = 0.25. Find the change in diameter, length and volume of the shell.	10M
	b)	Differentiate between thin cylinder and thick cylinder.	6M
7		Derive the expression for the crippling load by Rankine's method.	16M
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Code No: RT21032 **R13** SET - 3

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	State Hooke’s law	2
	b)	Write about different types of beams and different loadings.	4
	c)	Write about neutral axis and moment of resistance.	4
	d)	What is deflection, slope and radius of curvature in a beam?	3
	e)	Derive expression for circumferential stress in a thin cylindrical shell.	5
	f)	What do you mean by strength of a shaft?	4

PART –B

2		Derive the relation between three moduli of elasticity	16M
3		A beam of length is 10m is simply supported and carries point loads of 5kN each at a distance of 3m and 7m from left support and also a uniformly distributed load of 1 kN/m between the point loads. Draw the S.F.D and B.M.D	16M
4	a)	A Cantilever of length 2m fails when a load of 2kN is applied at the free end. If the section of the beam is 40m x 60m, find the stress at the failure.	8M
	b)	Prove that maximum shear stress in a circular section of a beam is 4/3 times the average shear stress.	8M
5	a)	A beam of span 8m and of uniform flexural rigidity EI= 40MN –m^2,is simply supported at its ends. It carries a uniformly distributed load of 15kN/m run over the entire span. It is also subjected to a clockwise moment of 160kNm at a distance of 3m from left support. Calculate the slope of the beam at the point of application of moment.	10M
	b)	Write about moment area method.	6M
6		Derive Lami’s equation of thick cylinders.	16M
7	a)	A solid cylindrical shaft is to transmit 300kW power at 100 r.p.m .If the shear stress is not to exceeed 80N/ mm^2,find its diameter.	6M
	b)	Derive the expression for the crippling load when both ends of the column are hinged.	10M
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Code No: RT21032 **R13** SET - 4

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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Define modular ratio, thermal stresses and thermal strain	4
	b)	Draw the B.M.D of simply supported beam with uniformly varying load with zero at free ends and w per metre run at the centre.	4
	c)	Draw the shear stress diagram of T section.	3
	d)	A cantilever of length 3.0m carries a point load of 12.5 kN at the free end. If moment of inertia of the beam is 1.00 x 10^8 mm^4 and value of E = 2 x 10^5 N/mm^2, determine the deflection at the free end.	3
	e)	Derive expression for longitudinal stress in a thin cylindrical shell.	5
	f)	Write the assumptions made in derivation of shear stress produced in circular shaft subjected to torsion.	3

PART -B

2	a)	Derive the relation between modulus of elasticity and modulus of rigidity.	8M
	b)	Determine the expression for strain energy stored in a body due to shear stress.	8M
3		A beam of length is 12m is simply supported and carries point loads of 6kN each at a distance of 4m and 8m from left support and also a uniformly distributed load of 2 kN/m between the point loads. Draw the S.F.D and B.M.D	16M
4		Derive the shear stress at any point in the cross section of a beam which is subjected to a shear force F.	16M
5	a)	A cantilever beam AB of length 4m carries a point load of 100kN at free end and another point load 100kN at 2m from the free end. If E =10^5N/mm^2 and I =10^8 mm^4 for the cantilever then determine the slope and deflection at the free end by Double integration method.	12M
	b)	Write in brief about Macualay's method.	4M
6	a)	A cylindrical vessel is 1.6m diameter and 5m long is closed at ends by rivets. It is subjected to an internal pressure of 4N/mm^2.If the maximum principal stress is not to exceed 120 N/mm^2, find the thickness of the shell. Assume E = 2 x 10^5 N/mm^2 and Poisson's ratio = 0.25. Find the change in diameter, length and volume of the shell.	10M
	b)	Differentiate between thin cylinder and thick cylinder.	6M
7		Derive the equation $\tau/R = C\theta/L = q/R$	16M
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