

OBJECTIVES

To impart adequate knowledge on how to analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials. Develop an understanding of the concepts of stress and strain and their use in the analysis and design of structures. To understand the failure phenomenon and learn how to prevent the failure. Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight. Perform engineering work in accordance with ethical and economic constraints related to the design of structures.

1. Group - A (Short Answer Questions)

S. No	Questions	Blooms Taxonomy Level	Program Outcom e
UNIT – I			
SIMPLE STRESSES AND STRAINS – STRAIN ENERGY			
1	What is the Principle of surveying	Understanding	a
2	Define Magnetic, True & Arbitrary Meridians.	Understanding	a
3	Mention different types of chains	Understanding	a
4	Differentiate between direct and indirect ranging.	Understanding	a
5	What is the Principle of chain surveying	Understanding	b
6	What are the Obstacles in chain surveying	Understanding	b
7	Write down the conditions for closed traverse	Understanding	b
8	Mention the Errors in chain surveying	Understanding remembering	b
9	Differentiate Between Prismatic Compass and Surveyors Compass	Understanding	c
10	Define local attraction	Understanding	c
UNIT- II			
SHEAR FORCE AND BENDING MOMENT			
1	Write about Methods of leveling	Understanding	d
2	Define Curvature & Refraction	Understanding	d

S. No	Questions	Blooms Taxonomy Level	Program Outcome
3	Write a note on Errors in leveling	Understanding remembering	d
4	Write a note on Temporary adjustments to leveling instrument	Understanding remembering	d
5	Define leveling	Understanding remembering	d
6	Define Benchmark	Understanding remembering	d
7	Draw a neat sketch to indicate the following : level surface, horizontal surface, vertical line, level line and horizontal line	Understanding remembering	d
8	Explain the differences between the height of collimation method and the rise and fall method of reduction of levels.	Understanding remembering	d
9	Define contour & Contour gradient	Understanding remembering	d
10	Mention the Method of plotting of contours	Understanding remembering	d
UNIT – III			
FLEXURAL STRESSES - SHEAR STRESSES			
1	Mention different methods of Calculation of area of traverse	understanding	e
2	Mention different methods of Calculation of area between a survey line and an irregular boundary	understanding	e
3	Mention different methods of Calculation of area of a plane figure	understanding	e
4	Write about Calculation of volumes using Simpson's & Trapezoidal rule	understanding	e
5	Write about Calculation of capacity of reservoir and barrow pits	Understanding	e
6	Write about prismoidal rule	understanding	f
7	Write about Mid-ordinate rule	Remembering	f
8	Write about Average - ordinate rule	Understanding & evaluate	f
9	Write about Trapezoidal rule	Understanding & evaluate	f
10	Write about Simpson's rule	Understanding & Evaluate	f
UNIT-IV			
PRINCIPAL STRESSES AND STRAINS – THEORIES OF FAILURE			
1	Define Principal plane.	understanding	g
2	Define principal stress. What are the methods used	understanding	g
3	What are the methods used to determine the stresses on oblique section?	remembering	g
4	What are the cases considered in determining the stresses on oblique section using analytical method ?	remembering	g
5	Define obliquity and write an expression for it.	understanding	g
6	What are the cases considered in determining the stresses on oblique section using graphical method?	remembering	g
7	Write short notes on Mohr's circle of stresses.	understanding	g
8	State distortion energy theorem for failure.	Understanding remembering	h

S. No	Questions	Blooms Taxonomy Level	Program Outcome
9	What do you understand by the term Theories of failure? Name the important theories of failure.	Understanding remembering	h
10	Explain the reasons why theory of failure is best suited for (i) ductile materials; (ii) Brittle materials	Understanding	h
UNIT – V			
DEFLECTION OF BEAMS – CONJUGATE BEAM METHOD			
1	Define deflection and slope.	Understanding	i
2	List out the different methods for finding slope and deflection of a beam.	Remembering	i
3	What is Macaulay’s method? Where is it used?	Remembering Understanding	i
4	What is moment area method? Where is it used?	Remembering Understanding	i
5	What is a cantilever? What are the different methods of finding slope and deflection of cantilever method?	Understanding	i
6	Define and explain the terms: conjugate beam, conjugate beam method, flexural rigidity.	Understanding	i
7	Write the boundary conditions for the following beams: Simply supported beam, cantilever beam.	Understanding remembering	i
8	What is the use of conjugate beam method over other methods?	Understanding	j
9	How will you use conjugate beam method for finding slope and deflection at any section of a given beam?	Remembering Understanding	j
10	What is the relation between an actual beam and the corresponding conjugate beam for different end conditions?	Understanding	j

2. Group - B (Long Answer Questions)

S. No	Questions	Blooms Taxonomy Level	Program Outcome
UNIT – I			
SIMPLE STRESSES AND STRAINS – STRAIN ENERGY			
1	What is the Principle of surveying	Understanding remembering	a
2	Write brief notes on a) Optical square b) Cross- staff c) Hypotenusal allowance	analyze	a
3	Write about different scales and maps	analyze	a
4	What are the sources of errors in surveying	analyze Apply	b
5	Classification of surveying in brief	analyze Apply	b
6	What are the objectives of surveying	analyze Apply	b
7	Explain with neat sketches, the following methods of locating a point by plane table survey. a) Radiation b) Intersection c) Resection	analyze Apply	b

S. No	Questions	Blooms Taxonomy Level	Program Outcome
8	Determine the back bearings corresponding to the following fore bearings a) $30^{\circ} 36'$ b. $190^{\circ} 10'$ c. $90^{\circ} 39'$ d. $286^{\circ} 51'$	analyze & Apply	c
9	Define three-point problem and show how it may be solved by tracing paper method.	analyze & Apply	c
10	Enlist and explain briefly the different methods of plane table surveying	analyze & Apply	c
UNIT – II			
SHEAR FORCE AND BENDING MOMENT			
1	Define Cross sectioning	Understanding	d
2	Write a note on Characteristics of contours	Understanding	d
3	Write a note on Uses and advantages of contours	Understanding	d
4	What do you mean by interpolation of contours	analyze ,Apply	d
5	What is profile leveling? Describe the procedure for conducting profile leveling of a proposed highway.	analyze ,Apply	c
6	What is cross-sectioning? What is its importance? How would you draw a longitudinal section and a cross section?	analyze ,Apply	d
7	Define Profile leveling	analyze ,Apply	d
8	What is bench mark? Explain different types of Bench marks	analyze & Apply	d
9	Two stations A and B are 1200 m apart. A level was set up between the two stations 100 m away from A. the readings observed were 1.375 m on A and 2.465 on B. Find the true difference in elevation between A and B.	analyze & Apply	d
10	Describe briefly the processes of i. Differential leveling ii. Profile leveling iii. Cross sectioning	analyze & Apply	d
UNIT – III			
INTERPOLATION AND CURVE FITTING			
1	Discuss the following methods of computation of area of a tract with straight but irregular boundaries. a. Mid-ordinate rule b. Average - ordinate rule c. Trapezoidal rule	Understanding	e
2	Derive the formula for Simpson's rule. What are its limitations?	analyze & Apply	e
3	Explain the double meridian distance (D.M.D) method for the computation of area of a closed traverse.	analyze & Apply	e
4	Describe the method of independent co – ordinates for computation of area. What are its advantages over the D.M.D. method?	analyze & Apply	f
5	Describe any two methods of the determination of area of triangle? How would you determine the area of a quadrilateral or a polygon by triangle method?	analyze & Apply	f
6	The following offsets were taken from a chain line to hedge	analyze &	f

S. No	Questions	Blooms Taxonomy Level	Program Outcome																				
	<table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 5px;"> <tr> <td style="width: 10%;">distance</td> <td style="width: 5%;">0</td> <td style="width: 5%;">20</td> <td style="width: 5%;">40</td> <td style="width: 5%;">60</td> <td style="width: 5%;">80</td> <td style="width: 5%;">120</td> <td style="width: 5%;">160</td> <td style="width: 5%;">220</td> <td style="width: 5%;">280</td> </tr> <tr> <td>offset</td> <td>9.4</td> <td>10.8</td> <td>13.6</td> <td>11.2</td> <td>9.6</td> <td>8.4</td> <td>7.5</td> <td>6.3</td> <td>4.6</td> </tr> </table> <p>Compute the area included between the chain line, the hedge and offset by Simpson's rule.</p>	distance	0	20	40	60	80	120	160	220	280	offset	9.4	10.8	13.6	11.2	9.6	8.4	7.5	6.3	4.6	Apply	
distance	0	20	40	60	80	120	160	220	280														
offset	9.4	10.8	13.6	11.2	9.6	8.4	7.5	6.3	4.6														
7	<p>Determine the area of the closed traverse ABCDE by the D.M.D. method</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">Line</th> <th style="width: 30%;">Departure in m</th> <th style="width: 50%;">Latitude in m</th> </tr> </thead> <tbody> <tr> <td>AB</td> <td style="text-align: center;">220</td> <td style="text-align: center;">120</td> </tr> <tr> <td>BC</td> <td style="text-align: center;">230</td> <td style="text-align: center;">-250</td> </tr> <tr> <td>CD</td> <td style="text-align: center;">-100</td> <td style="text-align: center;">-250</td> </tr> <tr> <td>DE</td> <td style="text-align: center;">-290</td> <td style="text-align: center;">100</td> </tr> <tr> <td>EA</td> <td style="text-align: center;">-60</td> <td style="text-align: center;">280</td> </tr> </tbody> </table>	Line	Departure in m	Latitude in m	AB	220	120	BC	230	-250	CD	-100	-250	DE	-290	100	EA	-60	280	analyze & Apply	f		
Line	Departure in m	Latitude in m																					
AB	220	120																					
BC	230	-250																					
CD	-100	-250																					
DE	-290	100																					
EA	-60	280																					
8	Taking the origin at 'A', determine the independent coordinates of the stations of the traverse in the above problem. Hence determine the area of the traverse.	analyze & Apply	f																				
9	Determine the area of the closed traverse given in problem(7) by the double parallel distance method.	analyze & Apply	f																				
10	Determine the included between the chain line, the hedge and end offsets in problem (6) by the trapezoidal rule.	analyze & Apply	f																				
UNIT – IV																							
PRINCIPAL STRESSES AND STRAINS – THEORIES OF FAILURE																							
1	<p>A rectangular bar is subjected to a direct stress (σ) in one plane only. Prove that the normal and shear stresses on an oblique plane are given by $\sigma_n = \sigma \cos^2 \theta$ and $\sigma_t = \frac{\sigma}{2} \sin 2\theta$</p> <p>Where θ = angle made by oblique plane with the normal cross-section of bar σ_n = normal stress; σ_t = tangential or shear stress</p>	analyze & Apply	g																				
2	<p>A rectangular bar is subjected to two direct stresses σ_1 and σ_2 in two mutually perpendicular directions. Prove that the normal stress and shear stress on an oblique plane which is inclined at an angle θ with the axis of minor stress are given by $\sigma_n = \sigma_1 + \sigma_2 + \sigma_1 - \sigma_2 \cos 2\theta$ and $\sigma_t = \sigma_1 - \sigma_2 \sin 2\theta$</p>	analyze & Apply	g																				
3	Derive an expression for the stresses on an oblique plane of a rectangular body, when the body is subjected to a simple shear stress.	analyze & Apply	g																				
4	<p>A rectangular body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress. Prove that the normal stress and shear stress on an oblique plane inclined at angle θ with the plane of major direct stress are given by $n = \sigma_1 + \sigma_2 + \sigma_1 - \sigma_2 \cos 2\theta + \tau \sin 2\theta$ and $t = \sigma_1 - \sigma_2 \sin 2\theta - s 2\theta$</p>	analyze & Apply	g																				
5	Derive an expression for the major and minor principal stresses on an oblique plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress.	analyze & Apply	g																				

S. No	Questions	Blooms Taxonomy Level	Program Outcome
6	Define and explain the theories of failure: (i) Maximum principal stress theory (ii) Maximum principal strain theory	Understanding	h
7	Define and explain the theories of failure: (i) Maximum shear stress theory (ii) Maximum shear strain energy theory	Understanding	h
8	A body is subjected to direct stresses in two mutually perpendicular principal tensile stresses accompanied by a simple shear stress. Draw the Mohr's circle of stresses and explain how you will obtain the principal stresses and strains.	Evaluate	h
9	A body is subjected to direct stresses in two mutually perpendicular directions. How will you determine graphically the resultant stresses on an oblique plane when (i) the stresses are unequal and unlike; (ii) the stresses are unequal and like.	Evaluate	h
10	Derive an expression for the distortion energy per unit volume when a body is subjected to principal stresses σ_1 , σ_2 and σ_3 .	analyze & Apply	h
UNIT – V			
DEFLECTION OF BEAMS – CONJUGATE BEAM METHOD			
1	Derive an expression for slope and deflection of a beam subjected to uniform bending moment.	analyze & Apply	i
2	Prove that the relation $M=EI d^2y / dx^2$ where M is Bending moment and E is modulus of elasticity and I is moment of inertia.	analyze & Apply	i
3	Prove that the deflection at centre of a simply supported beam, carrying a point load at centre, is given by $y_c = WL^3 / 48EI$	analyze & Apply	i
4	Derive the slope at supports and deflection at centre for a simply supported beam carrying uniformly distributed load of w per unit length over the entire span using Macaulay's method.	analyze & Apply	i
5	Find the slope and deflection of a simply supported beam carrying a (i) point load at the centre and (ii) Uniformly distributed load over the entire span using moment area method.	Apply	i
6	Derive slope and deflection of a cantilever carrying uniformly distributed load over whole length using Macaulay's method.	analyze & Apply	i
7	Derive slope and deflection of a cantilever carrying uniformly distributed load over a length 'a' from the fixed end by (i) double integration method, (ii) Moment area method..	analyze & Apply	i
8	Derive slope and deflection of a cantilever carrying a gradually varying load from zero at the free end to w/m run at the fixed end.	analyze & Apply	i
9	Find the slope and deflection of a simply supported beam carrying a point load centre, using conjugate beam method.	analyze & Apply	j
10	A cantilever carries a point load at the free end. Determine the deflection at free end using conjugate beam method.	analyze & Apply	j

3. Group - III (Analytical Questions)

S. No	Questions	Blooms Taxonomy Level	Program Outcome
UNIT – I			
VECTOR CALCULUS			
1	If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then what is $\Delta^2\left(\frac{1}{r}\right)$?	Understand	1
2	If $\text{curl } \vec{f} = \vec{0}$ then what is \vec{f} ?	Understand	1
3	If \vec{a} and \vec{b} are irrotational vectors then what is $\vec{a} \times \vec{b}$?	Understand	1
4	What is the physical interpretation of $ \Delta\phi $?	Understand	1
5	If $\text{div } \vec{A} = 0$ then what is called \vec{A} ?	Understand	1
6	What is $\int \text{f o g} \cdot d\vec{r}$?	Understand	2
7	What is the necessary and sufficient condition for the line integral $\int_c \vec{A} \cdot d\vec{r} = 0$ for every closed curve c ?	Understand	2
8	What is $\int \vec{r} \times \vec{n} dS$?	Understand	2
9	If $\vec{F} = ax\vec{i} + by\vec{j} + cz\vec{k}$ where a, b, c are constants then what is $\iint \vec{F} \cdot \vec{n} dS$ where s is the surface of the unit sphere?	Evaluate	2
10	If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then what is $\oint \vec{r} \cdot d\vec{r}$?	Understand	2
UNIT – II			
FOURIER SERIES AND FOURIER TRANSFORMS			
1	If $f(x)$ is an even function in the interval $-(l, l)$ then what is the value of b_n ?	Understand	5
2	If $f(x) = x$ in $(-\pi, \pi)$ then what is the Fourier coefficient a_2 ?	Understand	5
3	What are the conditions for expansion of a function in Fourier series?	Understand	4
4	If $f(x)$ is an odd function in the interval $-(l, l)$ then what are the value of a_0, a_n ?	Apply	5
5	If $f(x) = x^2$ in $-(l, l)$ then what is b_1 ?	Understand	5
6	What is the Fourier sine series for $f(x) = x$ in $(0, \pi)$?	Understand	5
7	What is the half range sine series for $f(x) = e^x$ in $(0, \pi)$?	Understand	5
8	What is the Fourier sine transform of $f(x) = x$?	Understand	6
9	What is the Fourier cosine transform of $f(x)$?	Understand	6
10	What is the $F_c \{e^{-at}\}$?	Understand	6
UNIT-III			
INTERPOLATION AND CURVE FITTING			
1	For what values of y the Gauss backward interpolation formula is used to interpolate?	Evaluate	8
2	For what values of y the Gauss forward interpolation formula is used to interpolate?	Evaluate	8
3	What is the difference between interpolation and extrapolation	Understand	7
4	Write a short note on difference equation	Remember	7
5	Write about curve fitting	Remember	7
6	If $y = a + \frac{b}{x}$ is a curve then write it's normal equations	Analyze	7
7	If $y = a_0 + a_1x + a_2x^2$ then what is the third normal equation of $\sum x_i^2 y_i$ by least squares method?	Analyze	7

S. No	Questions	Blooms Taxonomy Level	Program Outcome
8	If $y = a_0 + a_1 x^2$, then what is the first normal equation of $\sum y_i$?	Analyze	7
9	If $y = ax^b$, then what is the first normal equation of $\sum \log y_i$?	Analyze	7
10	If $y = 2x + 5$ is the best fit for 6 pairs of values (x, y) by the best method of least-squares, find $\sum x_i$ if $\sum y_i = 120$?	Apply	7
UNIT-IV			
NUMERICAL TECHNIQUES			
1	What is difference between polynomial and algebraic function?	Understand	10
2	What is Transcendental equation	Understand	10
3	Define root of an equation	Remember	10
4	What are the merits and demerits of Newton-Raphson Method	Understand	10
5	Explain about order of convergence?	Understand	10
6	Define linear, quadratic and cubic convergence?	Remember	10
7	Explain about False-position method	Understand	10
8	Explain about Regula-Falsi method	Understand	10
9	What is Crout's method in LU decomposition	Understand	11
10	What is Dolittle's method in LU decomposition	Understand	11
UNIT -V			
NUMERICAL INTEGRATION AND NUMERICAL SOLUTIONS OF DIFFERENTIAL EQUATIONS			
1	How many number of subintervals are required to get accuracy, while evaluating a definite integral by trapezoidal rule?	Analyze	12
2	What is the interval h for closer application, in Simpson's $\frac{1}{3}$ rule?	Analyze	12
3	What is the disadvantage of picard's method?	Understand	13
4	What is the method of Runge-Kutta method?	Understand	13
5	If $y_0 = 1, h = 0.2, f(x_0, y_0) = 1$ then by using Euler's method what is the value of y_1 ?	Understand	13
6	If $y_1 = 1.2, h = 0.2, f(x_1, y_1) = 1.4$ then by using Euler's method what is the value of y_2 ?	Understand	13
7	what is the iterative formula of Euler's method for solving $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$?	Understand	13
8	What is the n^{th} difference of a polynomial of degree n ?	Understand	13
9	If $\frac{dy}{dx} = x - y$ and $y(0) = 1$ then by picards method what is the value of $y^{(1)}(x)$?	Understand	13
10	What is the disadvantage of Euler's method over Modified Euler method?	Understand	13