Shivaji University, Kolhapur.
Civil Engineering
Scheme of Teaching & Examination
S.E. (Semester-III)

Sr. No.	Subject	Teaching Scheme per Week					Examination (Marks)				
		L	P	T	D	Total	Theory Paper	TW	POE	OE	Total
1	Engineering mathematics-III	3	-	1	-	4	100	25			125
2	Surveying-I	3	4	-	-	7	100	50	50	-	200
3	Strength of materials-I	3	2	-	-	5	100	25	-	25	150
4	Building Construction&materials	3	-	-	2	5	100	50	-	-	150
5	Fluid Mechanics-I	3	2	-	-	5	100	25	25	-	150
6	Numerical Methods	2	2	-	-	4	-	25	-	-	25
	Total	18	10	-	2	30	500	200	75	25	800

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Sr. No.	Subject	Code	Page No.
1.	Engineering mathematics-III	CE 201	01
2.	Surveying-I	CE 202	27
3.	Structural Mechanics-I	CE 203	41
4.	Building Construction and Material	CE 204	55
5	Fluid Mechanics-I	CE 205	64
6.	Numerical Methods	CE 206	74

Course Plan for Engg. Mathematics III

Course code	**CE201**	Course	**Engg. Mathematics III**
Prepared by	Mr.Bagal J.J.	Date	25/05/2018
Prerequisites			
1	Basic knowledge of derivative & integration		
2	Probability		
3	Types of relation between bivariate data		
4	Basic knowledge of Complex Numbers & its Properties		
5	Basic concepts of vectors		
Course Outcomes			
At the end of the course the students should be able to:			
CO201.1	**Identify**[1], **formulates**[4], and **solve**[3] Linear differential equation with constant coefficient & solve civil engg. Problems using LDE		
CO201.2	**Find**[3] differentiation of vectors, Divergence, Gradient, Curl and **identify**[4] irrotational and solenoidal vector field.		
CO201.3	**Fit**[3] the bivariate data to linear, exponential, quadratic form and to find correlation and lines of regressions.		
CO201.4	**Identify**[1] nature of random variable and apply proper probability distribution to solve examples.		
CO201.5	**Find**[6] Laplace transform and inverse Laplace transform of functions, **solve**[3] differential equations by using Laplace transform.		
CO201.6	**Identify**[1] analytic function & **evaluate**[6] complex integration		

Mapping of COs with POs

POs / COs	a	b	c	d	E	f	G	h	i	j	k	L
CO201.1		3				3						
CO201.2		2										

CO201.3		3				2						
CO201.4		3				2						
CO201.5		2										
CO201.6		2										

Degree of compliance: **1: Low,** **2: Medium** **3: High**

Course Contents

Unit No		No. of Hours
	SECTION-I	
I	**Unit 1. Linear Differential Equations (LDE) & Its Application** Linear Differential Equations with constant coefficients Types of solutions Applications of Linear Differential Equations with constant coefficients to Cantilever, Strut, Beam	**8**
II	**Unit 2. Vector Differential Calculus** Differentiation of vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function. Irrotational and solenoidal vector field.	**6**
III	**Unit 3. Curve Fitting:** Lines of regression of bivariate data, Fitting of Curves by method of Least-squares. Fitting of Straight lines Fitting of exponential curves. Fitting of Parabolic curves	**6**
	SECTION-II	
IV	**Unit 4. Probability Distributions:** Random variable Binomial Distribution Poisson Distribution Normal Distribution	**6**
V	**Unit 5. Laplace Transform** Definition, Transforms of elementary functions, Properties of Laplace transform. Transforms of derivatives and Integral.	**7**

	Inverse Laplace transforms formulae. Inverse Laplace transforms by using partial fractions and Convolution theorem. Solution of Linear differential equation with constants coefficients by Laplace transforms Method	
VI	**Unit 6. Calculus of Complex Functions** Functions of complex variable, Analytic function, necessary and sufficient conditions for f (z) to be analytic (without proof), Cauchy-Riemann equations in polar coordinates. Milne- Thomson method to determine analytic function f (z). Harmonic function, orthogonal trajectories. Complex integration, Cauchy's theorem and Cauchy's integral formula (without proof)	**8**

Reference Books:

1	A text book of Applied Mathematics: Vol. I, II and III by J. N. Wartikar & P. N. Wartikar Vidyarthi Griha Prakashan, Pune.
2	Higher Engineering Mathematics by Dr. B. S. Grewal
3	Probability and Statistics for Computer science by James L. Johnon (Wiley Student Edition).
4	Advance Engineering Mathematics, 9e, by Erwin Kreyszig (Wiley India.)
5	Mathematical Methods of Science and Engineering, by Kanti B. Datta (Cengage Learning.)
6	Higher Engineering Mathematics, by B. S. Grewal (Khanna Publication Delhi.)
7	Higher Engineering Mathematics, by B. V. Ramana (Tata McGraw-Hill)

Examination scheme

Examination Scheme	Theory	Term Work	POE	Total
Max. Marks	100	25	--	125
Contact Hours/ week	3	1	--	4

Scheme of Marks

Section	**Unit No.**	**Title**	**Marks**

I	1	Linear Differential Equations (LDE) & Its Applications	20
	2	Vector Differential Calculus	15
	3	Curve Fitting	15
II	4	Probability Distribution	15
	5	Laplace Transform	20
	6	Calculus of Complex Functions	15

Course Unitization:

Section	**Unit**		**Course Outcomes**	**No. of Questions in**	
	No.	**Title**		**CAT-I**	**CAT-II**
I	1	Linear Differential Equations (LDE)& Applications	CO201.1	Unit 1	Unit 2 and 5
	2	Vector Differential Calculus	CO201.2		
	3	Curve Fitting	CO201.3		
II	4	Probability Distribution	CO201.4		
	5	Laplace Transform	CO201.5		
	6	Calculus of Complex Functions	CO201.6		

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Linear Differential Equations (LDE)	Planned Hrs.	6
Lesson schedule					
Class No.	Details to be covered				
1	Introduction and Definition				
2	To find C.F. for Real & Complex Roots				
3	To find P.I. when X= $e^{ax}, \sin ax, \cos ax$				
4	To find P.I. when $x^m, e^{ax}V, xV$				
5	Applications of Linear Differential Equations with constant coefficients:Cantilevar				
6	Problems on Strut				
7	Problems on Beam				
8	Examples				

Review Questions		
Q1	Solve $\left(D^4+4D^3+8D^2+8D+4\right)y=0$	
Q2	Solve $\left(D^2-2D+1\right)y=e^x+1$	
Q3	Solve $(D^2+4D+4)y=\frac{e^{-2x}}{x^5}$	
Q4	Solve $\left(D^4-3D^2-4\right)y=48\sin x\cos x$	
Q5	The deflection of struct with one end built in and the other supported and subjected to end thrust p satisfies the equation $\frac{d^2y}{dx^2}+a^2y=\frac{a^2R}{p}(l-x)$ Given that $\frac{dy}{dx}=y=0$ *when* $x=0$ *and* $y=0$ *when* $x=l$. Prove $y=\frac{R}{p}\left(\frac{\sin ax}{a}-l\cos ax+l-x\right)$ *where* $al=\tan al$	

Unit No	**2**	Unit Title	Vector Differential Calculus	Planned Hrs.	**6**

Lesson schedule	
Class No.	Details to be covered
1	Introduction and Definition
2	Vector Differential Operator Del
3	To find Gradient of scalar point function & Directional Derivative
4	Divergence of Vector point function
5	Curl of Vector point function
6	Irrotaional & Solenoidal

Review Questions		
Q1	Find the directional derivative of $\phi=x^2y+y^2z+z^2x$ at (2,2,2) in the normal to the surface $4x^2y+2z^2=2$ at (2,-1,3)	
Q2	Prove that $\nabla\left(\frac{1}{r}\right)=-\frac{\bar{r}}{r^3}$ where $\bar{r}$ = xi+yj+zk	

Q3	Find the directional derivative of $\phi = x^2yz + 4xz^2 + xyz$ at (1, 2, 3) in the direction of 2i+j+k	
Q4	Calculate divergence and curl of the vector $\overline{F} = \left(x^2 + yz\right)i + \left(y^2 + zx\right)j + \left(z^2 + xy\right)k$	
Q5	Show that $\overline{f} = (y+z)i + (z+x)j + (x+y)k$ is solenoidal	
Q6	Show that $\overline{F} = \left(x^2 - yz\right)i + \left(y^2 - zx\right)j + \left(z^2 - xy\right)k$ is irrotational and find its scalar potational.	
Q7	If $\overline{F} = \left(y\sin z - \sin x\right)i + \left(x\sin z + 2yz\right)j + \left(xy\cos z + y^2\right)k$ then prove that it is irrotational & hence find its scalar potential	

Unit No	**3**	Unit Title	Curve Fitting	Planned Hrs.	**6**

Lesson schedule

Class No.	Details to be covered
1	Introduction and principal of least squares
2	Fit to linear form i.e. $y = a + bx$ and exponential form i.e. $y = ab^x, y = ax^b$ etc
3	Fitting of data to linear and quadratics form i.e. $y = a + bx + cx^2$
4	To find regression coefficients for bivariate data
5	To find lines of regressions
6	To find mean, coefficient of correlation

Review Questions

Q1	Find the curve of the best fit of the type $y = ae^{bx}$ to the following data by the method of least square.
Q2	For a certain data the regression equations are $3x + 2y = 26$ *and* $6x + y = 31$. Find $\overline{x}, \overline{y}$ *and* r.
Q3	From the following result obtain two regressions and estimate i) y when x=29 and ii) x when y=600

x	1	5	7	9	12
y	10	15	12	15	21

x y

	Mean 26.7 508.4 Standard Deviation 4.6 36.8 Where r=0.52	
Q4	Find the best fitting of the type $y = ax^b$ to the following data x: 1 2 3 4 5 6 y: 2 16 54 128 250 432	
Q5	For the following data fit a curve of the type $y = ab^x$ to the following data x: 2 3 4 5 6 y: 144 172.8 207.4 248.8 298.5	
Q6	Find the equation of lines of regression and the best estimate of x for y=8 and y for x=13 for the following data x: 2 4 6 8 12 14 y: 4 2 5 10 11 12	
Q7	Fit a straight line to the following data x: 0 1 2 3 4 y: 1 1.8 3.3 4.5 6.3	

Unit No	**4**		Probability distribution	Planned Hrs.	**6**

Lesson schedule

Class No.	
1	Introduction and types of random variables
2	Examples on discrete and continuous random variable
3	Binomial probability distribution
4	Poisson probability distribution
5	Examples
6	Normal probability distribution

Review Questions

Q1	Find the value of k if the following function is a probability function $f(x) = ke^{-\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2} \quad ;\infty < x < \infty$	

	Where m is real and $\sigma>0$	
Q2	Fit a Poisson distribution to the following data x 0 1 2 3 4 *Total* f 192 100 24 3 1 320	
Q3	A fair coin is tossed 10 times. Find the probability that the coin shows head (i) exactly 2 times (ii) at most 2 times (iii) at least 8 times	
Q4	Assume that on the average one telephone number out of 15 called 2 p.m. and 3 p.m. on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called (i) not more than 3 (ii) at least 3 of them will be busy	
Q5	If the probability that an individual suffers a bad reaction from a certain injection is 0.001, determine the probability that out of 2000 individuals (i) exactly 3 (ii) more than 2 will suffer a bad reaction	
Q6	In an intelligence test administered on 1000 children the average was 42 and S.D. was 24 (i) Find the number of children exceeding a score 50 and (ii) Number of children lying between 30 and 40.	
Q7	In a large institution 2.28% of employees receive income below Rs.4500 P.M. and 15.87% of employees receive income above Rs 7500P.M. Assuming that the income follows normal distribution. Find the mean and S.D. of the distribution.	
Q8	The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination?	
Q9	A random variable x has the following probability function x : 0 1 2 3 4 5 6 7 $P(x)$: 0 k $2k$ $2k$ $3k$ k^2 $2k^2$ $7k^2+k$ (i) Find k (ii) Evaluate P(x<6) and P (3<x≤6)	

Unit No	**5**		Laplace Transform	Planned Hrs	**7**

Lesson schedule	
Class No.	Details to be covered
1	Introduction and Definition
2	Laplace Transform of some elementary functions

3	Properties of Laplace Transform
4	Inverse Laplace Transform
5	Inverse Laplace Transform by Convolution Theorem
6	Applications to IVP & Heviside unit step function
7	Examples

Review Questions

Q1	Find the Laplace transform of $\frac{e^{2t}-\sin 3t}{t}$	
Q2	Find the Laplace transform of periodic function $f(t)=\frac{kt}{T},\ 0<t<T,\ f(t+T)=f(t)$	
Q3	Evaluate $\int_0^{\infty} e^{-3t}t\cos t\,dt$	
Q4	Find $L^{-1}\left\{\frac{3s+7}{s^2-2s-3}\right\}$	
Q5	Using Laplace transform find the solution of initial value problem $\frac{d^2y}{dt^2}+9y=18t;\ y(0)=0, y^1(0)=0$	

Unit No	6		Calculus of Complex Functions	Planned	**8**

Lesson schedule

Class No.	
1	Introduction & Definition
2	Functions of complex variable
3	Analytic function, N & S condition for f (z) to be analytic
4	Cauchy-Riemann equations in polar coordinates
5	Milne- Thomson method to determine analytic function f (z).
6	Harmonic function, orthogonal trajectories
7	Complex integration, Cauchy's theorem
8	Cauchy's integral formula

Review Questions

Q1	Show that $f(z)=e^z$ is analytic	
Q2	If $f(z)=u+iv$ be analytic then show that family of curves $u=c_1, v=c_2$	

	where $c_1 \& c_2$ are constants intersect orthogonally	
Q3	If $u = e^x(x\cos y - y\sin y)$ then determine whether u is harmonic & if it is harmonic & find corresponding analytic function	
Q4	Evaluate $\int \lvert z\rvert dz$ along the left half the unit circle $\lvert z\rvert = 1$ for $z = -i$ to $z = i$	
Q5	Evaluate $\int_c \frac{3z^2}{z^2-1} dz$ where c is the circle $\lvert z\rvert = 2$	

Model Question Paper

Course Title :		**Engg.Mathematics-III**	**Max. Marks**
Duration		**3 hours**	**100**
		Instructions: • **All questions are compulsory** • **Figures to the right indicates full marks** • **Use of non-programmable calculator is allowed**	
		Section-I	
			Marks
1		**Attempt any FOUR**	**20m**
	a	Solve $(D^2+4D+4)y = \frac{e^{-2x}}{x^5}$	**5m**
	b	Solve $\left(D^4+4D^3+8D^2+8D+4\right)y = 0$	**5m**
	c	Solve $\left(D^2-D+1\right)y = x^3-3x^2+1$	**5m**
	d	Solve $\left(D^3-2D^2-5D+6\right)y = \left(e^{2x}+3\right)^2$	**5m**
	e	The deflection of struct with one end built in and the other supported and subjected to end thrust p satisfies the equation $\frac{d^2y}{dx^2} + a^2y = \frac{a^2R}{p}(l-x)$ Given that $\frac{dy}{dx} = y = 0$ *when* $x = 0$ *and* $y = 0$ *when* $x = l$. Prove $y = \frac{R}{p}\left(\frac{\sin ax}{a} - l\cos ax + l - x\right)$ *where* $al = \tan al$	**5m**

2 — **Attempt any THREE** — **15m**

A — Find the directional derivative of $\phi = xy + yz + xz$ at (1, 2, 3) in the direction of 2i+j+k — **5m**

B — Calculate divergence and curl of the vector $\overline{F} = \left(x^2 - yz\right)i + 2xyj + \left(y^2 - xy\right)k$ — **5m**

c — Show that $\overline{F} = \left(3x^2 - 3yz\right)i + \left(3y^2 - 3zx\right)j + \left(3z^2 - 3xy\right)k$ is irrotational and find its scalar potational. — **5m**

d — Prove that $\nabla\left(\frac{1}{r}\right) = -\frac{\bar{r}}{r^3}$ where $\bar{r}$ = xi+yj+zk — **5m**

3 — **Attempt any THREE** — **15m**

a — Calculate the correlation coefficient from the following data. Hence comment — **5m**

x	100	98	85	92	90	84	88	90	93	95
y	500	610	700	600	670	800	800	750	700	690

b — Find the lines of regression for the following data — **5m**

x	10	14	19	26	30	34	39
y	12	16	18	26	29	35	38

And determine the reliability of estimate of y for x=14.5

c — From the following result obtain two regressions and estimate i) y when x=29 and ii) x when y=600 — **5m**

	x	y
Mean	26.7	508.4
Standard Deviation	4.6	36.8

Where r=0.52

d — Find the best fitting of the type $y = ax^b$ to the following data — **5m**

	1	2	3	4	5	6
	2	16	54	128	250	43

Section-II

4 — **Attempt any THREE** — **15m**

a — The overall percentage of failures in a certain examination is 20. If six candidates appear in the examination, what is the probability that at least five pass the examination? — **5m**

b — Fit a Poisson distribution to the following data: — **5m**

x	0	1	2	3	4	Total
y	211	90	19	5	0	325

	c	Find the value of K, if the following function is a probability density function $f(x)=K\frac{1}{1+x^2};\ -\infty<x<\infty$	**5m**
	d	In a sampling the mean number of defective bolts manufactured by a machine in a sample of 20 is 2. Determine the expected number of samples out of such 500 samples to contain at least two defective bolts	**5m**
5		**Attempt any FOUR**	**15m**
	a	Find the Laplace transform of $\frac{\cos at-\cos bt}{t}$	**5m**
	b	Find $L^{-1}\left\{\frac{2s^2-4}{(s+1)(s-2)(s-3)}\right\}$	**5m**
	c	Find $L^{-1}\left\{\frac{1}{s^2(s+3)^2}\right\}$ by Convolution Theorem	**5m**
	d	Using Laplace transform find the solution of initial value problem $\frac{d^3y}{dt^3}-2\frac{d^2y}{dt^2}+\frac{dy}{dt}-2y=0;\ y(0)=0, y^1(0)=0, y^{II}(0)=6$	**5m**
	e	Find $L^{-1}\left\{\frac{2s^2-4}{(s-2)(s-3)}\right\}$	**5m**
6		**Attempt any THREE**	**15m**
	a	If $u=e^x(x\cos y-y\sin y)$ then determine whether u is harmonic & if it is harmonic & find corresponding analytic function	**5m**
	b	Prove that $u=x^3-3xy^2$ is harmonic. Also find analytic function $f(z)$ given that $f(0)=1$	**5m**
	c	Evaluate $\int_c \frac{e^{2z}}{z+1}dz$ where c is the circle $\lvert z\rvert=2$	**5m**
	d	Evaluate $\int_c \frac{3z^2}{z^2-1}dz$ where c is the circle $\lvert z\rvert=2$	**5m**

Assignments

List of experiments/assignments to meet the requirements of the syllabus		
Assignment No. 1		
Assignment Title	**Linear Differential Equations (LDE) and Applications**	**CO201.1**

Batch I	1. $\frac{d^4y}{dx^4} - y = \cos x \cosh x$ 2. $(D^2 + 2D + 1)y = e^{-x} \log x$ 3. $\frac{d^4y}{dx^4} - 4y = x \sinh x$ 4. $(D-2)^2 y = 8(e^{2x} + \sin 2x + x^2)$ 5. $(D^5 - D)y = 5e^x$ 6. $(D^2 - 4D + 3)y = \cos^2\left(\frac{\sqrt{3}}{2}x\right)$ 7. $(D^2 + 4D + 4)y = \frac{e^{-2x}}{x^5}$ 8. A horizontal strut of length L is clamped at one end and carries a vertical load W at the free end. the horizontal thrust at the end is P and its differential equation is given by $EI\frac{d^2y}{dx^2} = (\delta - y)P + W(L - x)$ Where y is the displacement of a point at a distance x from the fixed end and δ is the deflection at the free end. Prove that the deflection at the free end is given by $\frac{w}{EI}(\tan nl - nl)$ Where $n^2 EI = P$	
Batch II	1. $(D^5 - D)y = 5e^x$ 2. $(D^2 - 4D + 3)y = \cos^2\left(\frac{\sqrt{3}}{2}x\right)$ 3. $\frac{d^3y}{dx^3} - 4\frac{dy}{dx} = 2\cosh^2 2x$ 4. $\left[(D^2+1)^3\left(D^2 + D + 1\right)^2\right]y = 0$ 5. $(D^2 + 4D + 4)y = \frac{e^{-2x}}{x^5}$ 6. $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^3 + e^{2x} + \cos 2x$ 7. $\frac{d^4y}{dx^4} - 4y = x \sinh x$ 8 A horizontal strut of length L is clamped at one end and carries a vertical load W at the free end. the horizontal thrust at the end is P and its differential equation is given by	

	$EI\frac{d^2y}{dx^2}=(\delta-y)P+W(L-x)$ Where y is the displacement of a point at a distance x from the fixed end and δ is the deflection at the free end. Prove that the deflection at the free end is given by $\frac{w}{EI}(\tan nl-nl)$ Where $n^2EI=P$.
Batch III	1. $(D^2-3D+2)y=\frac{1}{e^{e-x}}+\cos\left(\frac{1}{e^x}\right)$ 2. $(D^2+a^2)y=\tan ax$ 3. $x^2\frac{d^3y}{dx^3}+3x\frac{d^2y}{dx^2}+\frac{dy}{dx}=x^2\log x$ 4. $(D^2-4D+3)y=\cos^2\left(\frac{\sqrt{3}}{2}x\right)$ 5. $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=x^3+e^{2x}+\cos 2x$ 6. $(D^2+4D+4)y=\frac{e^{-2x}}{x^5}$ 7. $\frac{d^4y}{dx^4}-4y=x\sinh x$ 8 A horizontal strut of length L is clamped at one end and carries a vertical load W at the free end. the horizontal thrust at the end is P and its differential equation is given by $EI\frac{d^2y}{dx^2}=(\delta-y)P+W(L-x)$ Where y is the displacement of a point at a distance x from the fixed end and δ is the deflection at the free end. Prove that the deflection at the free end is given by $\frac{w}{EI}(\tan nl-nl)$ Where $n^2EI=P$.

Assignment No. 2

Assignment Title	**Vector Differential Calculus**	**CO201.2**
Batch I	1. A vector field is given by $\overline{A}=(x^2+xy^2)i+(y^2+x^2y)j$. Show that the field is irrotational and find the scalar	

potential.

2. Find the unit vector normal to the surface $xy^3z^2 = 4$ at (-1, -1, 2)
3. Prove that $\nabla\left(\frac{1}{r}\right) = -\frac{\bar{r}}{r^3}$ where $\bar{r}$ = xi+yj+zk
4. Find $div(\phi\nabla\psi)$ at (1, 1, 1) where $\phi = xy^2z^3$ and $\psi = xy^2 + zy^2 + z^2x$
5. Prove that $\nabla^2(\log r) = \frac{1}{r^2}$
6. Find the directional derivative of $\left(\bar{V}\right)^2$, where $\bar{V} = xy^2i + zy^2j + xz^2k$ at the point (2, 0, 3) in the direction of the outward normal surface to the sphere $x^2 + y^2 + z^2 = 14$ at the point (3, 2, 1).
7. Show that $\bar{F} = \left(3x^2 - 3yz\right)i + \left(3y^2 - 3zx\right)j + \left(3z^2 - 3xy\right)k$ is irrotational and find its scalar potential.
8. If $\bar{r} = xi + yj + zk$ and $\bar{a}$ and $\bar{b}$ are constant vectors Prove that,

$$\bar{a}.\nabla\left(\bar{b}.\nabla\frac{1}{r}\right) = 3\frac{\left(\bar{a}.\bar{r}\right)\left(\bar{b}.\bar{r}\right)}{r^5} - \frac{\left(\bar{a}.\bar{r}\right)}{r^3}$$

Batch II

1. Prove that, for every field $\bar{V}$, div curl $\bar{V}$ = 0
2. Find the angle between two surfaces $x^2y + z = 3$ and $x\log z - y^2 + 4 = 0$ at $(-1, 2, 1)$.
3. Prove that $\nabla^2(\log r) = \frac{1}{r^2}$

	4. If $\bar{a}$ is a constant vector and $\bar{r} = xi + yj + zk$ Prove that curl ($\bar{a} \times \bar{r}$) $= 2\bar{a}$. 5. Show that $\bar{F} = (3x^2 - 3yz)i + (3y^2 - 3zx)j + (3z^2 - 3xy)k$ is irrotational and find its scalar potential. 6. Prove that $\nabla\left(\frac{1}{r}\right) = -\frac{\bar{r}}{r^3}$ where $\bar{r}$ = x i + y j + z k 7. Find the directional derivative of $\phi = xy + yz + xz$ at (1, 2, 3) in the direction of 2i+j+k 8. Find the directional derivative of $(\bar{V})^2$, where $\bar{V} = xy^2 i + zy^2 j + xz^2 k$ at the point (2, 0, 3) in the direction of the outward normal surface to the sphere $x^2 + y^2 + z^2 = 14$ at the point (3, 2, 1).
Batch III	1. If $\bar{a}$ is a constant vector and $\bar{r} = xi + yj + zk$ Prove that curl ($\bar{a} \times \bar{r}$) $= 2\bar{a}$. 2. Find the directional derivative of $(\bar{V})^2$, where $\bar{V} = xy^2 i + zy^2 j + xz^2 k$ at the point (2, 0, 3) in the direction of the outward normal surface to the sphere $x^2 + y^2 + z^2 = 14$ at the point (3, 2, 1). 3. A vector $\bar{r}$ is defined by $\bar{r} = xi + yj + zk$. If $\lvert\bar{r}\rvert = r$ then show that vector $r^n \bar{r}$ is irrotational. 4. A vector field is given by $\bar{A} = (x^2 + xy^2)i + (y^2 + x^2 y)j$. Show that the field is irrotational and find the scalar potential. 5. Show that the gradient field describing a motion is irrotational. 6. Find the directional derivative of $\phi = xy + yz + xz$ at (1, 2, 3) in

the direction of 2i+j+k

7. Find the unit vector normal to the surface $xy^3z^2 = 4$ at (-1, -1, 2)
8. If $\overline{F} = (y\sin z - \sin x)i + (x\sin z + 2yz)\,j + (xy\cos z + y^2)k$ then prove that it is irrotational & hence find its scalar potential

Assignment No. 3

Assignment Title	**Curve Fitting**	**CO201.3**

Batch I

1. Given

	X	Y
mean	985	12.8
S.D.	70.1	1.6

And r= 0.52

Find two lines of regressions.

2. Following data is related and sale of certain commodity collected for a week

Price(*Rs*)	10.50	9.75	10.00	10.75	10.25	10.50	10.285
Sale(*Kgs*)	25	30	28	22	24	24	20

Find equation of line of regression for estimating the sale if price is known, Also find sale of the commodity if price is 10.60 Rs.

3 Obtain the coefficient of correlation for the following data

x	78	36	98	25	75	82	90	62	65	39
y	84	51	91	60	68	62	86	58	53	47

4 Find the line of regression for the following data

x	10	14	19	26	30	34	39
y	12	16	18	26	29	35	38

And determine the reliability of estimate of y for x = 14.5

5 Fit a parabola $y = ax^2 + bx + c$ for the following data by the Least Square Method

x	10	12	15	23	20
y	14	17	23	25	21

6 For the following data fit a curve of the form $y = ax^b$

	x 1 2 3 4 5 6 y 1200 900 600 200 110 50 7 Fit a second parabola for the following data x 0 1 2 3 4 y 1 4 10 17 30
Batch II	1 Fit a straight for the following data x 0 1 2 3 4 y 1 1.8 3.3 4.5 6.3 2 Fit a parabola $y = ax^2 + bx + c$ for the following data by the Least Square Method x 10 12 15 23 20 y 14 17 23 25 21 3 Find the line of regression for the following data x 10 14 19 26 30 34 39 y 12 16 18 26 29 35 38 And determine the reliability of estimate of y for x = 14.5 4 For the following data fit an exponential curve x 1 2 3 4 5 6 y 1200 900 600 200 110 50 5 Compute Spearman's rank correlation coefficient r for the following data *Ranks in Maths* 9 10 6 5 7 2 4 8 1 3 *Ranks in Stat* 1 2 3 4 5 6 7 8 9 10 6 Find the curve of best fit of the type $y = ae^{bx}$ to the following data by the method of least square x 1 5 7 9 12 y 10 15 12 15 21 7 Obtain the coefficient of correlation for the following data x 78 36 98 25 75 82 90 62 65 39 y 84 51 91 60 68 62 86 58 53 47
Batch III	1. Obtain the Karl Pearson's coefficient of correlation for the following data

	x 25 27 30 35 33 28 36 y 19 22 27 28 30 33 28 2. Fit the regression line y on x & x on y for the following data and also find regression coefficient x 1 3 4 6 8 9 11 14 y 1 2 4 4 5 7 8 9 3 Fit a parabola $y = ax^2 + bx + c$ for the following data by the Least Square Method x 10 12 15 23 20 y 14 17 23 25 21 4 The following data regarding the heights & weights of the 100 college students are given by $\Sigma x = 15000$; $\Sigma y = 6800$; $\Sigma x^2 = 2272500$; $\Sigma y^2 = 463025$; $\Sigma xy = 1022250$. Find the correlation coefficient between height & weight. Also state the equation of regression of height on weight. 5 Consider the two regression lines $3x + 2y = 26$ and $6x + y = 31$. a) Find the mean value & correlation coefficient between x & y b) If the variance of y is 4, find the standard deviation of x 6 From the following data Obtain two regression lines & the Karl Pearson's coefficient of correlation $Sales(x)$ 100 98 78 85 110 93 80 $Purchase(y)$ 85 90 70 72 95 81 74 7 The equations of two lines of regressions are $6y = 5x + 90$; $15x = 8y + 130$ find the mean of x and y and r

Assignment 4

Assignment Title	**Probability Distribution**	**CO201.4**
Batch I	1. Find value of K, if f(x) is probability density function, $f(x) = k(1-x^2)$; $1 \le x \le 3$ ` $= 0$ *Otherwise* 2. The Probability density function of a random variable x is zero except at x = 0, 1, 2. At these points P (0) =$3c^3$, P (1) = 4c -$10c^2$, P (2) = 5c -1. Find c and $P(0 < x \le 2)$ 3. Seven coins are tossed and the number of heads obtained is noted. The experiment is repeated 128 times and the following distribution	

	is obtained *No of Heads* 0 1 2 3 4 5 6 7 *Total* *Frequency* 7 6 19 35 30 23 7 1 128 Fit a Binomial Distribution for the above Data 4. In a sampling the mean number of defective bolts manufactured by a machine in a sample of 20 is 2. Determine the expected number of samples out of such 500 samples to contain at least two defective bolts 5. Fit a Poisson distribution to the following data x: 0 1 2 3 4 *Total* f: 109 65 22 3 1 200 6 The probability that a student in a collage will graduate is 0.4. find the probability that out of 5 student i)None ii) one iii) at least one will graduate 7 Weights of four thousand students are found to be normally distributed with mean fifty kilograms and standard deviation five kilograms. Find the number of students with weights i) Less than 45 kgs ii) between 45 and 60 kgs
Batch II	1. The number of arrivals of customers during any day follows Poisson distribution with a mean of five. What is the probability that the total number of customers on two days selected at random is less than five? 2. If on an average one ship in every ten is wrecked, find the probability that out of five ships expected to arrive, four at least will arrive safely. 3 In a sampling the mean number of defective bolts manufactured by a machine in a sample of 20 is 2. Determine the expected number of samples out of such 500 samples to contain at least two defective bolts 4 Weights of four thousand students are found to be normally distributed with mean fifty kilograms and standard deviation five kilograms. Find the number of students with weights ii) Less than 45 kgs ii) between 45 and 60 kgs 5 Find the value of k if the following function is a probability density

	function $f(x)=\begin{cases} kx^2\left(1-x^3\right);\ 0\le x\le 1 \\ 0 \qquad\qquad ;otherwise \end{cases}$ 6 The probability that a student in a collage will graduate is 0.4. find the probability that out of 5 student i)None ii) one iii) at least one will graduate 7 Assuming that 20% of the population of a city are literate, so that the chance of an individual being literate is 1/5 and assuming that 100 investigators each take 10 individuals to see whether they are literate, hoe many investigators would you except to report 3 or less were literate.
Batch III	1. A manufacturer knows that the razor blades he makes contain an average 0.5% of defective. He packs them in packets of 5. What is the probability that a packet picked at random will contain 3 or more faculty blades? 2. The diameter of an Electric Cable is assumed to be continuous random variate with probability density function $f(x)=6x(1-x)\ \ 0\le x\le 1$then i) Verify that above is a probability density function. ii) Find the mean and variance 3. In an experience with 500 seeds in groups of 5 the following results were obtained x 0 1 2 3 4 5 *Total* f 10 70 150 160 80 30 500 Where f denotes the number of groups in which x seeds germinated. Fit a binomial distribution to the data. 4. If 10% of bolts produced by a machine are defective. Determine the probability that out of 10 bolts chosen at random. i) One ii) None iii) At most two Bolts will be defective. 5. Using Poisson distribution find the probability that the ace of spades will be drawn from a pack of well shuffled cards at least once in 104 consecutive trials. 6 In a sampling the mean number of defective bolts manufactured by a machine in a sample of 20 is 2. Determine the expected number of samples out of such 500 samples to contain at least two defective bolts 7 In a sample of 1000 cases, the mean od a ertain test is 14 and

	standard deviation is 2.5. Assuming the distribution to be noemal find: i) How many students score between 12 and 15? ii) How many students score above 18?

Assignment 5

Assignment Title	**Laplace Transform**	**CO201.5**

Batch I

1 Find $L\left\{e^{-3t}(2\sin 5t-3\cos 7t)\right\}$

2 Find $L\left\{e^{-3t}(2\cos 5t-3\sin 5t)\right\}$ $L\left\{t^2e^{-t}\sin 4t\right\}$

3 Evaluate $\int_0^{\infty} e^{-3t}t\cos t\,dt$

4 Find $L^{-1}\left\{\frac{2s^2-4}{(s-2)(s-3)}\right\}$

5 Find $L^{-1}\left\{\frac{1}{s^2(s+3)^2}\right\}$ by Convolution Theorem

6 Find the Laplace transform of $\frac{\cos 3t-\cos 2t}{t}$

7 Using Laplace transform find the solution of initial value problem

$$\frac{d^2y}{dt^2}+y=\sin t;\ y(0)=1, y^1(0)=\frac{-1}{2}$$

8 Using Laplace transform find the solution of initial value problem

$$\frac{d^3y}{dt^3}-2\frac{d^2y}{dt^2}+\frac{dy}{dt}-2y=0;\ y(0)=0, y^1(0)=0, y^{II}(0)=6$$

Batch II

1. Find $L\left\{e^{-2t}(2\sin 3t-3\cosh 4t)\right\}$
2. Find $L\left\{t\ e^{-2t}\cos 3t\right\}$
3. Evaluate $\int_0^{\infty}\frac{e^{-2t}-e^{-3t}}{t}$
4. Find the Laplace transform of $\frac{e^{2t}-\sin 3t}{t}$
5. Find the Laplace transform of periodic function

	$f(t)=\frac{kt}{T},\ 0<t<T,\ f(t+T)=f(t)$ 6. Find $L^{-1}\left\{\frac{s^2+10s+13}{(s-1)(s^2-5s+6)}\right\}$ 7. Find $L^{-1}\left\{\frac{1}{s^2(s+3)^2}\right\}$ by Convolution Theorem 8. Using Laplace transform find the solution of initial value problem $\frac{d^3y}{dt^3}-2\frac{d^2y}{dt^2}+\frac{dy}{dt}-2y=0;\ y(0)=0, y^1(0)=0, y^{ll}(0)=6$
Batch III	1 Find $L\{e^{-2t}(10\cos 4t-20\sin 5t)\}$ 2 Find $L\left\{\frac{d}{dt}(t\sin 2t)\right\}$ 3 Find the Laplace transform of $\frac{\cos at-\cos bt}{t}$ 4 Find the Laplace transform of $\frac{e^{2t}-\sin 3t}{t}$ 5 Find $L^{-1}\left\{\frac{4s+5}{(s-1)^2(s+2)}\right\}$ 6 Find the Laplace transform of periodic function $f(t)=\frac{kt}{T},\ 0<t<T,\ f(t+T)=f(t)$ 7 Find $L^{-1}\left\{\frac{s^2}{(s^2+a^2)^2}\right\}$ by Convolution Theorem 8 Using Laplace Transform find the solution of initial value problem $\frac{d^2y}{dt^2}-\frac{dy}{dt}+2y=12e^{-2t};\ y(0)=2, y^1(0)=6$

Assignment 6

Assignment Title	**Calculus of Complex Functions**	**CO201.6**
Batch I	1. Prove that $u=x^3-3xy^2+3x^2-3y^2+1$ is Harmonic function & find corresponding analytic function. 2. Verify the function is harmonic & find analytic function $u=2x(1-y)$	

	3. Evaluate $\int_c \lvert z\rvert^2 dz$ where c is the boundary of the square with vertices (0,0),(1,0),(1,1),(0,1) 4. Evaluate $\int_{1-i}^{2+i} (2x+iy+1)dz$ along the curve $x=t+1, y=2t^2-1$ 5. Evaluate $\int_c \frac{dz}{z^3(z+4)}$ where c is the circle $\lvert z\rvert=2$ 6. Evaluate $\int_c \frac{e^{2z}}{z+1}dz$ where c is the circle $\lvert z\rvert=\frac{1}{2}$ 7. Evaluate $\int_c \mathrm{Re}(z)dz$ where c is the straight line joining 0 to 1+i 8. Evaluate $\int_c \frac{e^z}{(z-1)(z-4)}dz$ where c is the circle $\lvert z\rvert=2$
Batch II	1. Prove that $u=x^3-3xy^2+3x^2-3y^2+1$ is Harmonic function & find corresponding analytic function. 2. If $f(z)=u+iv$ is an analytic function of z & $u-v=e^x(\cos y-\sin y)$ Find $f(z)$ in terms of z 3. Evaluate $\int_c \lvert z\rvert^2 dz$ where c is the boundary of the square with vertices (0,0),(1,0),(1,1),(0,1) 4. Evaluate $\int_0^{1+i} (x-y+ix^2)dz$ along the straight line from z=0 to z=I and then from z=I to z=1+i 5. Evaluate $\int_c \frac{dz}{z^3(z+4)}$ where c is the circle $\lvert z\rvert=1$ 6. Evaluate $\int_c \frac{z+6}{z^2-4}dz$ where c is the circle $\lvert z-2\rvert=1$ 7. Evaluate $\int_0^{3+i} \bar{z}dz$ along the straight line 0 to 3+i 8. Evaluate $\int_c \frac{e^z}{(z-1)(z-4)}dz$ where c is the circle $\lvert z\rvert=2$

Batch III

1. If $u = e^x\left(x\cos y - y\sin y\right)$ then determine whether u is harmonic & if it is harmonic & find corresponding analytic function
2. Verify the function is harmonic & find analytic function $u = 2x(1-y)$
3. Evaluate $\int_{1-i}^{2+i}(2x+iy+1)\,dz$ along the curve $x = t+1, y = 2t^2-1$
4. Evaluate $\int_c \frac{dz}{z^3(z+4)}$ where c is the circle $|z| = 2$
5. Evaluate $\int_c \frac{3z^2}{z^2-1}dz$ where c is the circle $|z| = 2$
6. Evaluate $\int_c \mathrm{Re}(z)\,dz$ where c is the straight line joining 0 to 1+i
7. Evaluate $\int_c \frac{e^z}{(z-1)(z-4)}dz$ where c is the circle $|z| = 2$
8. Evaluate $\int_0^{1+i}\left(x-y+ix^2\right)dz$ along the straight line from z=0 to z=I and z=1 to z=1+i

Course Plan for Surveying- I

Course code	CE 202	Course	Surveying- I
Prepared by	Mr. D. R. Patil & Mr. N. M. Patil	Date	28/05/2018
Prerequisites	Students should have basic knowledge of linear measurements by chain and tape. Knowledge of bearing measurement by prismatic compass, types of bearing and traverse.		
Course Outcomes			
At the end of the course the students should be able to:			
CO 202.1	**Explain**[5]and perform permanent adjustment of dumpy level, Concept of Sensitivity of bubble tube, errors in levelling and its elimination.		
CO 202.2	**Compare**[4] methods of contouring and interpolation and compute area and volume by various methods.		
CO 202.3	**Explain**[5]and describe the principle, working and methods of plane table surveying.		
CO 202.4	**Explain**[5] parts of theodolite and its function, methods of vertical angle and horizontal angle measurements, concept of trigonometric leveling and solving problems on trigonometric leveling.		
CO 202.5	**Explain**[5] and perform traversing by theodolite, types of traverses, errors and its adjustment of errors, Gales traverse table and numerical on omitted measurements.		
CO 202.6	**Explain**[5] hydrographic survey, surveys for mines, tunnels etc. working of minor instruments such as Hand level, Abney level, Ghat tracer etc.		

Mapping of COs with POs

POs / COs	a	b	c	d	E	F	G	h	i	J	k	L
CO202.1	1				3				3			
CO202.2					2			1	2			
CO202.3		2			2				2			
CO202.4	2				1						2	
CO202.5	3				3							
CO202.6			2									

Course Contents

Unit No.	Title	No. of Hours
	Section I	
1.	Levelling and Contouring a) Types, components and use of levels, Types of levelling, objectives and applications b) Adjustments of dumpy and tilting level c) Sensitivity of bubble tube, Corrections – curvature and refraction d) Contouring – methods and applications	9
2.	Areas and volumes a) Planimeter – types and applications b) Trapezoidal and Simpsons rule c) Capacity contouring	5
3.	Plane Table Surveying a) Principles, accessories, significance and adjustments b) Methods and applications of plane table survey	4
	Section II	
4.	Theodolite a) Vernier theodolite – components, uses and adjustments b) Applications – Trigonometrical levelling	6
5.	Theodolite traversing a) Objectives, traverse table, plotting b) Omitted measurements	7
6.	Applications a) Usage of minor instruments for different surveys b) Hydrographic survey c) Tunnel survey d) Reconnaissance, preliminary and detailed survey for road and railway projects	5

Reference Books:

Sr. No.	Title of Book	Author	Publisher/Edition	Topics
1	Surveying Vol. I, II and III	Dr. B.C. Punmia	Laxmi Publishers, New Delhi	All
2	Surveying and Levelling Vol. I and II	T.P Kanetkar and S.V Kulkarni	Pune VidhyarthiGruha	All
3	Surveying Vol. I, II and III	Dr. K.R. Arora	Standard Book House, New Delhi	All

4	Surveying Vol. I and II	S. K. Duggal	Tata Mcgraw Hill, New Delhi	All
5	Surveying and Levelling	N.N. Basak	Tata Mcgraw Hill, New Delhi	All
6	Surveying and Levelling	R. Agor	Khanna Publishers, New Delhi	All
7	Plane surveying	David Clark		All

Examination scheme

Examination Scheme	Theory	Term Work	POE	Total
Max. Marks	100	50	50	200
Contact Hours/ week	3	4	--	7

Scheme of Marks

Section	Unit No.	Title	Marks
I	1, 2 and 3	Levelling and Contouring, Areas and volumes, Plane Table Surveying.	50
II	4, 5 and 6	Theodolite, Theodolite traversing, Applications.	50

Course Unitization

Section	Unit		Course Outcomes	No. of Questions in	
	No.	Title		CAT-I	CAT-II
I	1	Levelling and Contouring	CO202.1, CO202.2	1	
	2	Areas and volumes	CO202.2	1	
	3	Plane Table Surveying	CO202.3	1	
II	4	Theodolite	CO202.4		1
	5	Theodolite traversing	CO202.5		1
	6	Applications	CO202.6		1

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Levelling and Contouring	Planned Hrs.	9 hrs.

Lesson schedule	
Class No.	Details to be covered
1	Introduction to subject and units in subject. Types, components and use of levels.
2	Different types of leveling, Surveying, their objectives and application.
3	Introduction to construction and permanent adjustment of Dumpy Level. Fundamental lines of Dumpy level and their relationships.
4	Errors in leveling like error due to Curvature, Refraction and Combined. Corrections for these errors. Its derivation and numerical.
5	Introduction to reciprocal leveling, derivation and numerical on reciprocal leveling.
6	Precise leveling introduction, classification of precise leveling depending on error of closure. Study of field procedure and precautions to be taken in precise leveling.
7	Introduction to contour, basic definitions, uses of contour maps for various purposes. Application of contour maps in engineering field.
8	Introduction to method of contouring, study of direct method of contouring. Introduction to indirect method of contouring.
9	Study of indirect method of contouring, contour interpolations method and sketching of contour.

Review Questions		
Q1	What are different methods used in leveling.	CO202.1
Q2	List and explain different parts of Dumpy level with their uses.	CO202.1
Q3	Enlist the fundamental axes of a dumpy level. Indicate the desired relationship amongst them.	CO202.1
Q4	Describe the field procedure to be followed while determining sensitivity of a bubble tube. Also derive the corresponding equation.	CO202.1
Q5	Define contour, contour interval and horizontal equivalent.	CO202.2
Q6	Explain the characteristics of contour.	CO202.2

Section I

Unit No	2	Unit Title	Areas and volumes	Planned Hrs.	5 hrs.

Lesson schedule	
Class No.	Details to be covered
1	Introduction to measurement of area by instruments, study of mechanical planimeter, zero circle concept and equation,
2	Study of digital planimeter, introduction and derivation to measurement of area by mid ordinate rule, average ordinate rule.
3	Introduction and derivation to measurement of area by trapezoidal rule and Simpsons rule.
4	Numerical on area calculation by trapezoidal rule and Simpsons rule.
5	Introduction to volume calculations. Numerical on volume calculation by trapezoidal rule and Prismoidal formula.

Review Questions

Q1	Draw a neat sketch of mechanical planimeter and explain its working.	CO202.2
Q2	Explain procedure of finding constant of planimeter from known area.	CO202.2
Q3	State different methods of computation of area.	CO202.2

Section I

Unit No	3	Unit Title	Plane Table Surveying	Planned Hrs.	4 hrs.

Lesson schedule	
Class No.	Details to be covered
1	Introduction to principle of plane table surveying, equipments and accessories of plane table.
2	Study of different methods of plane table surveying like method of Radiation, Intersection, Traversing and Resection.
3	Study of two point problem, three point problem and methods of solving two point and three point problems.
4	Use of plane table for contouring, use of tangent clinometers and telescopic alidade.

Review Questions		
Q1	What is the principle of plane table survey?	CO202.3
Q2	State the advantages and disadvantages of plane table survey over other types of surveying.	CO202.3
Q3	Distinguish between plane and telescopic alidade.	CO202.3

Section II

Unit No	4	Unit Title	Theodolite	Planned Hrs.	6 hrs.

Lesson schedule	
Class No.	Details to be covered
1	Introduction to theodolite, basic definitions, parts of theodolite. Temporary adjustment of theodolite, reading Vernier's of theodolite.
2	Procedure for measurement of horizontal angle by repetition method, deflection angle.
3	Procedure for measurement of horizontal angle by reiteration method.
4	Procedure for measurement of vertical angle and magnetic bearing using theodolite.
5	Introduction to trigonometric leveling single plane method, derivation and numerical on it.
6	Derivation and numerical on double plane method of trigonometric leveling

Review Questions		
Q1	Explain Various parts of theodolite with neat sketch	CO202.4
Q2	Explain repletion method of angle measurement	
Q3	Draw scale diagram for angle $120^{0}45'20"$	
Q4	Describe the procedure of measuring deflection angle using theodolite	
Q5	How will you determine the RL of top of hill when its base is not accessible	

Section II					
Unit No	5	Unit Title	Theodolite traversing	Planned Hrs.	7 hrs.
Lesson schedule					
Class No.	Details to be covered				
1	Introduction to theodolite traversing, selection of traverse stations, marking of stations and types of traverse.				
2	Study of methods of traversing like included angle method, deflection angle method.				
3	Study of methods of traversing like fast angle/ needle method, checks in open and closed traverse.				
4	Computations of Latitude and Departure, closing error. Introduction to balancing of traverse.				
5	Balancing of traverse by Bowditch's rule, Transit rule and Third rule. Numerical on balancing of traverse.				
6	Procedure of traversing and preparation of Gale's traverse table.				
7	Introduction to omitted measurements, numerical on Latitude and Departure with incomplete data.				
Review Questions					
Q1	Describe various methods of traversing with theodolite and discuss their merits and demerits.				CO202.5
Q2	What is mean by balancing of traverse				
Q3	What are field checks in a) closed traverse b) open traverse				
Q4	What are sources of error in theodolite observation?				
Q5	What are various rules for balancing of traverse				
Q6	Write short note on omitted measurement in traversing				
Section II					
Unit No	6	Unit Title	Applications	Planned Hrs.	5 hrs.
Lesson schedule					
Class No.	Details to be covered				
1	Introduction to Hydrographic survey, sounding and methods of sounding.				
2	Introduction to tunnel survey and mine survey.				
3	Introduction to minor instruments like Hand level, Abney level, Box sextant, Ceylon ghat tracer etc. and their use.				
4	Introduction to surveys for engineering projects, reconnaissance, preliminary and detailed survey.				
5	Use of survey in setting out a building.				
Review Questions					
Q1	Write short note on Hydrographic Survey.				CO202.6
Q2	Explain ghat tracer with neat sketch				

Q3	Write short note Abney level and Hand level	
Q4	Explain various methods of sounding methods	
Q5	Explain various steps involved in any engineering projects	

Model Question Paper

Course Title :	Surveying -I	
Duration 3 hours		Max. Marks 100

Instructions:
Figures to the right indicate marks.
Assume suitable data if necessary and state the assumptions made clearly.

		Section-I	
			Marks
1	a	Derive expressions for curvature, refraction and combined correction for curvature and refraction.	8
	b	What relationship is assessed with two peg method? Calculate correct reading at Q and error of collimation for the data.	9

Instrument At	Staff reading on	
	P	Q
P	3.125	1.480
Q	2.575	1.085

2	a	What is 'zero circle' explain briefly. Give the expression of zero circle with meaning of each term.	7
	b	Following offsets from a traverse line to an irregular boundary were measured and the data is as under. Calculate the area between the traverse line and the irregular boundary in hectares by i) Trapezoidal rule. ii) Simpson's rule.	10
3	a	What is meant by orientation? Explain methods of orientation.	4
	b	Define two point problem, explain the detailed procedure with neat diagram for solving the two point problem in the field.	8
	c	Explain advantages and dis-advantages of plane table survey method	4

Chainage (m)	0	5	10	15	20	25
Offset (m)	6.15	10.92	9.03	11.58	14.22	12.33

		Section-II	
			Marks
1	a	Define the following. i) Swinging. ii) Transiting. iii) Face left. iv) Face right.	8

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>b</td><td>Find the elevation of top of chimney from the following data.
<table>
<tr><th>Station (Inst)</th><th>Staff Reading on B.M (m)</th><th>Angle of Elevation</th><th>Remarks</th></tr>
<tr><td>A</td><td>0.865</td><td>$18^0 36'$</td><td rowspan="2">R.L of B.M= 421.380m
Dist. Between A and B= 50m</td></tr>
<tr><td>B</td><td>1.220</td><td>$10^0 12'$</td></tr>
<tr><td colspan="4">Stations A, B and top of chimney are in same vertical plane</td></tr>
</table></td><td>9</td></tr>
<tr><td>2</td><td>a</td><td>Write short note on Balancing of traverse</td><td>7</td></tr>
<tr><td></td><td>b</td><td>Following observations were taken from station P and Q. calculate the length and bearing of AB.
<table>
<tr><td>Line</td><td>PA</td><td>PQ</td></tr>
<tr><td>Length</td><td>225</td><td>200</td></tr>
<tr><td>Bearing</td><td>$S60^0 30'W$</td><td>$N30^0 30'E$</td></tr>
</table></td><td>10</td></tr>
<tr><td>3</td><td>a</td><td>Explain ghat tracer with neat sketch</td><td>8</td></tr>
<tr><td></td><td>b</td><td>Write Short note on Sounding Methods</td><td>8</td></tr>
</table>

Lab Plan

<table>
<tr><td colspan="3">List of experiments to meet the requirements of the syllabus</td></tr>
<tr><td>Experiment No</td><td>Experiment Title</td><td>CO</td></tr>
<tr><td>1</td><td>Differential and reciprocal levelling with dumpy, tilting and autolevel</td><td>CO1</td></tr>
<tr><td>2</td><td>Sensitivity of bubble tube</td><td>CO1</td></tr>
<tr><td>3</td><td>Permanent adjustments of dumpy and tilting levels</td><td>CO1</td></tr>
<tr><td>4</td><td>Area measurements by mechanical and digital planimeter</td><td>CO2</td></tr>
<tr><td>5</td><td>Methods of plane table survey</td><td>CO3</td></tr>
<tr><td>6</td><td>Measurement of horizontal angles by different methods by theodolite</td><td>CO4</td></tr>
<tr><td>7</td><td>Measurement of vertical angles by theodolite</td><td>CO4</td></tr>
<tr><td>8</td><td>Measurement of bearing, deflection angle, and prolonging of line by theodolite</td><td>CO4</td></tr>
<tr><td>9</td><td>Trigonometrical levelling – both planes by theodolite</td><td>CO5</td></tr>
<tr><td>10</td><td>Usage of minor instruments</td><td>CO6</td></tr>
<tr><td colspan="3">List of assignments to meet the requirements of the syllabus (same assignment to all batches)</td></tr>
<tr><td colspan="3">Assignment No. 1</td></tr>
<tr><td>Assignment Title</td><td>Leveling and Contouring</td><td>CO202.1, CO202.2</td></tr>
<tr><td colspan="3">Q1) Differentiate between the following.
i) Auto level and dumpy level
ii) Fly leveling and profile leveling
iii) Permanent adjustment and temporary adjustment</td></tr>
</table>

Q2) Write short notes on.

i) Precise leveling.
ii) Reciprocal leveling
iii) Sensitivity of bubble tube.
iv) Auto level and special features in auto level.

Q3) Explain with neat diagram how the procedure of reciprocal leveling eliminates effect of refraction, curvature and error of collimation.

Q4) Derive expressions for curvature, refraction and combined correction for curvature and refraction.

Q5) why is it necessary to consider correction for curvature and refractions? Work out their values for sight length of 1.0 Km.

Q6) Explain use of precise level. Also explain precautions to be taken in precise leveling.

Q7) Enlist the fundamental axes of a dumpy level. Indicate the desired relationship amongst them. Describe in detail permanent adjustment of dumpy level.

Q8) What relationship is assessed with two peg method? Calculate correct reading at Q and error of collimation for the data.

Instrument At	Staff reading on	
	P	Q
P	3.125	1.480
Q	2.575	1.085

Q9) Describe the field procedure to be followed while determining sensitivity of a bubble tube. Also derive the corresponding equation.

Q10) A dumpy level was tested by the two peg method and the following results were obtained

Instrument at	Staff readings at	
	A	B
Midway of A and B	1.000	1.645
On point O_1, 12m behind A	1.428	1.823

Distance between two pegs A and B is 80m. Find the staff readings on A and B to give horizontal line of sight when instrument is set at O_1.

Q11) Following data gives the observations with a dumpy level during reciprocal leveling operation. Find

i) True reduced level of B.
ii) Combined correction for curvature and refraction.
iii) Error due to collimation.

Instrument near	Staff readings on	Remarks

	A	B	
A	1.150	2.320	Dist. AB= 1.10 Kms
B	0.655	1.815	RL of A= 505.125 m

Q12) The following observations refer to the reciprocal levels taken with one level

Instrument near	Staff readings on		Remarks
	A	B	
A	1.158	2.594	Dist. AB= 1200 m
B	0.983	2.411	RL of A= 650.575 m

Find

a) True R.L of B.
b) Combined correction for curvature and refraction.
c) Error in collimation.

Q13) Define the following.

i) Contour.
ii) Contour interval.
iii) Horizontal equivalent.

Q14) State the uses of contour maps. Explain how the capacity of reservoir is calculated using a contour map.

Q15) Write the stepwise procedure to be followed in direct contouring with plane table.

Q16) Explain methods of direct contouring with neat sketch.

Q17) Explain methods of In-direct contouring with neat sketch.

Q18) What are different methods of interpolating contours, explain briefly.

Assignment No. 2

Assignment Title	Areas and volumes	CO202.2

Q1) Explain theory of planimeter. Give expressions for calculating area with help of planimeter. State terms used in it.

Q2) What is 'zero circle' explain briefly. Give the expression of zero circle with meaning of each term.

Q3) State different methods of computation of area, explain Trapezoidal rule with its statement and derive its expressions.

Q4) Explain Simpson's rule with its statement and derive its expression.

Q5) Compare trapezoid rule and Simpson's rule.

Q6) The following offsets were taken from a chain line to an irregular boundary line at an interval of 15 m.
0, 3.15, 3.85, 5.18, 4.52, 3.79, 0 m.
Compute area between chain line, irregular boundary and the end offset by

i) Average ordinate rule.
ii) The trapezoidal rule.
iii) Simpson's rule.

Q7) The perpendicular offsets taken at 12m interval from a survey line to an irregular boundary are 2.22, 3.80, 4.45, 6.68, 5.33, 7.18, 8.58, 8.05 and 5.23m. Determine the area enclosed by trapezoidal rule and Simpson's rule.

Q8) Following offsets from a traverse line to an irregular boundary were measured and the data is as under. Calculate the area between the traverse line and the irregular boundary in hectares by

iii) Trapezoidal rule.
iv) Simpson's rule.

Chainage (m)	0	5	10	15	20	25	30	35	40
Offset (m)	6.15	10.92	9.03	11.58	14.22	12.33	9.72	10.32	7.65

Q9) State the Trapezoidal rule (Average End Area rule) and prismoidal formula for calculating volume.

Q10) An embankment of width 10m and side slopes 1.5:1 is required to be made on a ground which is level in a direction transverse to the center line. The central heights at 20m intervals are 0.83, 1.28, 2.19, 2.52, 1.85, 1.46 and 0.90m.
Calculate the volume of earthwork according to

i) Trapezoidal Rule.
ii) Prismoidal formula.

Q11) The areas within the contour lines at the side of a reservoir and along the face of a proposed dam are as under.

Contour	250	248.5	247	245.5	244	242.5	241	239.5	238
Area (Sq.m)	705600	642600	508500	461700	295200	157500	83700	11700	360

If the bottom level is 238.000 and the full reservoir level is 250.000, determine the capacity of reservoir by Trapezoidal and Prismoidal formula.

List of additional assignments /experiments

Assignment No. 3

Assignment Title	Plane Table Surveying	CO202.3

Q1) What is meant by orientation? Explain methods of orientation.

Q2) write a detailed note on Radiation method of plane table.

Q3) write a detailed note on Intersection method of plane table.

Q4) write a detailed note on Traversing method of plane table.

Q5) write a detailed note on Resection method of plane table.

Q6) Define two point problem, explain the detailed procedure with neat diagram for solving the two point problem in the field.

Q7) Explain the graphical method of solving three point problem.

Q8)Write a short note on strength of fix.

Q9)Draw a neat sketch of telescopic alidade and explain use of each component. Explain how this is used for direct method of contouring.

List of open ended experiments/assignments

Assignment No. 4

Assignment Title	Theodolite	CO202.4

Q1) Define the following.

i. Centering.
ii. Swinging.
iii. Transiting.
iv. Face left.
v. Face right.

Q2) Write stepwise procedure for temporary adjustments of a Transit theodolite.
Q3) Name the fundamental lines of a transit theodolite and state their desired inter relationships.

Q4) Describe the procedure of measuring bearing (whole circle bearing) using theodolite.

Q5) Describe the procedure of measuring deflection angle using theodolite.

Q6) Describe the procedure of measuring horizontal angle by repetition and reiteration method and state its suitability.

Q7) Describe stepwise the field procedure to be followed during measurement of vertical angles using a transit theodolite. support your description with the help of a specimen example.

Q8) Explain how you would set $38^0470'20"$ right deflection angle using a transit theodolite.

support your explaination with a neat sketch.

Q9) Draw a neat sketch of vernier scale readings

a) $231^0 44'40"$
b) $278^0 48'20"$
c) $151^0 24'40"$
d) $335^0 33'40"$

Q10) Justify the statement- Even though the least count of theodolite is 20", angle can be measured to an accuracy of 7" to 8".

Q11) What is the purpose of

i) Making face left and face right observations.
ii) Observing readings on both the vernier.
iii) Adopting repetition method of horizontal angle measurement.

Q12) How will you determine the reduced level of the top of a transmission tower when its base is not accessible?

Q13) Explain by deriving necessary expressions, the double plane method to determine the reduced level of an elevated point.

Q14) Determine elevation of top of chimney for following observations.

Instrument Station	Staff Reading on B.M (m)	Angle of Elevation	Remarks
A	1.275	$19^0 24'$	R.L of B.M= 245.500m
B	1.105	$7^0 14'$	Dist. Between A and B= 50m

Q15) Find the elevation of top of chimney from the following data.

Instrument Station	Staff Reading on B.M (m)	Angle of Elevation	Remarks
A	0.865	$18^0 36'$	R.L of B.M= 421.380m
B	1.220	$10^0 12'$	Dist. Between A and B= 50m

Stations A, B and top of chimney are in same vertical plane.

Q16) calculate R.L of top and base of chimney and its distance from instrument station for the following data.

Instrument Station	Staff Reading on B.M (m)	Angle of Elevation	Remarks
A	0.895	$18^0 46'$	R.L of B.M= 380.380m
B	1.250	$9^0 12'$	Dist. Between A and B= 65m

Stations A, B and top of chimney are in same vertical plane. Height of chimney is 15m.

List of experiments/assignments to meet the requirements of the syllabus

Assignment No. 5

Assignment Title	Theodolite traversing	CO202.5

Q1) what is mean by traversing explain its types with neat sketch.

Q2) What are field checks in closed traverse and open traverse.

Q3) Write short note on Balancing of Traverse

Q4) Explain various rules for balancing of traverse.

Q5) Define the consecutive co ordinate?

Q6)Write short note on omitting measurements

Q7) For the traverse shown below compute the length CD so that A, D and E may be in one straight line.

Line	AB	BC	CD	DE
Length in m.	110	165	?	212
WCB	84^0	$34^045'$	$345^030'$	$20^020'$

Q8) Following observations were taken from station P and Q. calculate the length and bearing of AB.

Line	PA	PQ	QB
Length	225	200	250.50
Bearing	$S60^030'W$	$N30^030'E$	$N50^015'W$

Assignment No. 6

Assignment Title	Applications	CO202.6

Q1) Explain advantages on minor instruments in surveying.

Q2) Explain Ghat Tracer with neat sketch

Q3) Explain how to measure level with using Hand level with neat sketch

Q4) Write short note on Hydrographic Survey

Q5) What are different method for sounding?

Q6) Explain use of Box Sextant with neat sketch

Q7) What are different steps in engineering project survey

Q8) Explain Procedure to setting out building

Course Plan for Strength of materials

Course code	CE 203	Course	Strength of materials
Prepared by	Mr. S. P. Deshamukh	Date	29/05/2018
Prerequisites	Students should know basic concepts of applied mechanics such as forces, equilibrium, beams, trusses and M.I.		
Course Outcomes			
At the end of the course the students should be able to:			
CO203.1	**Discuss**[3] the response of elastic body for external actions.		
CO203.2	**Draw**[3] SFD & BMD for the given beam.		
CO203.3	**Analyze**[4] circular shafts & thin walled cylinders.		
CO203.4	**Calculate**[3] bending stress distribution for given beams.		
CO203.5	**Calculate**[3] shear stress distribution for given beams.		
CO203.6	**Explain**[2] strain energy & deflection at any point for truss, bent or beam.		

Mapping of COs with POs

Pos / COs	A	B	C	d	E	f	G	h	I	j	k
CO203.1	2	2					3				
CO203.2					2				1		
CO203.3			1				2				1
CO203.4				1							
CO203.5						1				2	
CO203.6	1				1				2		

1 Mild correlation 2 Moderato correlation 3 Strong correlation

Course Contents

Unit No.	Title	No. of Hours
	Section I	
1.	Engineering properties of different materials, St.Venant's principle, simple stress and strain, Hooke's law, elastic behavior of the body under external actions , composite sections under axial loading, temperature stresses , elastic constants , normal stresses and strains in three dimensions .	9 Hrs
2.	Analysis of statically determinate beams S.F. and B.M. diagrams,	6 Hrs

	virtual work approach for computation of shear force and bending moment.	
3.	Analysis of circular shafts subjected to torsion, power transmitted. Analysis of thin walled cylinders.	5 Hrs
Section II		
4.	Bending Stresses in beams, simple design problems	6 Hrs
5.	Shear stress distribution in beams	5 Hrs
6.	Strain energy due to different types of actions, impact loading. Strain energy method for deflection of determinate beams, bents and trusses	9 Hrs

Reference Books:

Sr. No.	Title of Book	Author	Publisher/Edition	Topics
1.	"Strength of Materials"	S Ramamrutham	DhanapatRai Publications	1,3,6
2.	"Mechanics of Materials" Vol I & II	Punmia, Jain	Laxmi Publications	2,4
3	"Strength of materials" Vol I	S.S.Bhavikatti	Vikas Publications	5

Examination scheme

Examination Scheme	Theory	Term Work	OE	Total
Max. Marks	100	25	25	150
Contact Hours/ week	3	2	--	05

Scheme of Marks

Section	Unit No.	Title	Marks
I	1	Unit No 1 Engineering Properties	16
	2	Unit No 2 Shear Force and Bending Moment Diagram	18
	3	Unit No 3 Torsion	16

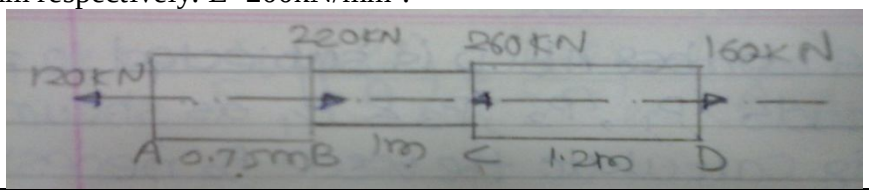
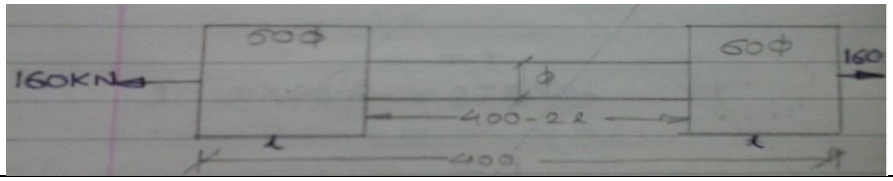
II	4	Unit 4 Bending stress	16
	5	Unit 5 Shear stress	18
	6	Unit 6 Strain Energy	16

Course Unitization

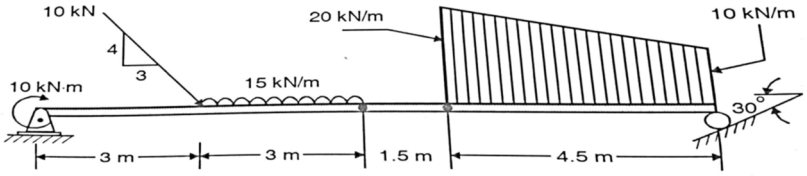
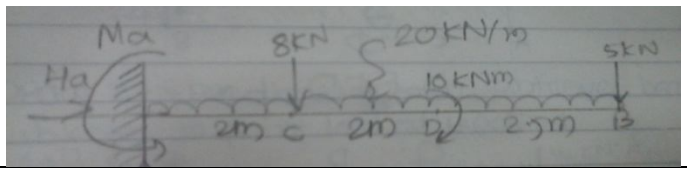
CO	Evaluation	Notes
CO203.1	CAT 1	3 questions with mixing of sub questions from chapters 1,2 & 3
CO203.2		
CO203.3		
CO203.4	CAT 2	3 questions with mixing of sub questions from chapters 3,4 & 6
CO203.5		
CO203.6		

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Simple stresses & strains	Planned Hrs.	9 Hrs
Lesson schedule					
Class No.	Details to be covered				
1	Engineering properties of different materials.				
2	St.Venant's principle.				
3	Simple stress and strain & Hook's law.- Numericals.				
4	Elastic behavior of the body under external actions.				
5	Composite sections under axial loading. - Numericals.				
6	Temperature stresses. - Numericals.				
7	Elastic constants. - Numericals.				
8	Normal stresses and strains in three dimensions. - Numericals.				
9	Numericals.				
Review Questions					
Q1	Write short note in stress, strain & Hook's law.				CO203.1

Q2	What is principle of superposition?	CO203.1
Q3	Define Poisson's ratio & volumetric strain.	CO203.1
Q4	Find the net change in the length of member ABCD loaded axially as shown in fig. If each portion have square c/s of sides 35mm, 20mm & 25mm respectively. E=200kN/mm^2. 	CO203.1
Q5	A bar shown in fig. below subjected to tensile load of 160 kN. If stress in middle portion is limited to 160N/mm^2, determine dia. Of middle portion. Also find the length of the same portion if total elongation of bar is to be 0.2mm. E=2.1x10^5 N/mm^2. 	CO203.1
Q6	The tensile test was conducted on M.S.bar. The following readings were observed, 1. Dia. Of bar=3cm 2. Gauge length=20cm 3. Load at elastic limit=250kN 4. Extension at load of 150kN=0.21mm 5. Max. load=380kN 6. Total extension=60mm 7. Dia. Of rod at failure=2.25cm. Find: Young's modulus, stress at elastic limit,% elongation & % decrease in area.	CO203.1
Q7	Reinforced concrete column 400x400 mm in section is reinforced with 8 bars of 20 mm dia. The column carries a load of 360 kN. Find the stresses in steel & concrete. Take E_s=2.1x10^{5}Mpa& E_c=0.14x10^{5}Mpa.	CO203.1
Q8	A steel rod 25 mm dia. having E=2x10^{5}Mpa & α_s=12x10^{-6}/^{0}C passes centrally through the copper tube of 45 mm external dia. & 35 mm internal dia. The tube is covered by rigid plates at both ends. The assembly is heated till the temp. rises by 60^0 C & simultaneously loaded by an axial tensile force of 20 kN. E & α for Cu are 1.2x10^5 Mpa & 18x10^{-5}/^{0}C respe. Find the stresses in two materials.	CO203.1
Q9	A cube of 40 mm side is subjected to force of 55 kN tensile, 70 kN compressive & 50 kN tensile along x,y & z directions respe. If E=2x10^{5}Mpa & m=10/3, calculate change in volume & % change in volume.	CO203.1

Unit No	2	Unit Title	Shear Force & Bending Moment Diagrams	Planned Hrs.	6 Hrs

Lesson schedule		
Class No.	Details to be covered	
1	Shear force & bending moment theory.	
2	Numericals on SFD & BMD	
3	Numericals on SFD & BMD	
4	Numericals on SFD & BMD	
5	Numericals on SFD & BMD	
6	Numericals on SFD & BMD	
Review Questions		
Q1	Define determinate & indeterminate structures.	CO203.2
Q2	What is shear force & bending moment?	CO203.2
Q3	State importance of point of contraflecture.	CO203.2
Q4	What is relation between shear force & bending moment?	CO203.2
Q5	A beam ABCDEF is supported at A & E. The beam carries a point load of 58KN acting vertically downloads at B; another point load of 85 KN at point C making an angle of 71.5650 with horizontal; a udl of 18 KN/m from D to F and a clockwise couple of 56 KNm at F. If support A is hinged and support E is roller support, draw SFD & BMD. Length(AB)=0.5m, L(BC)=L(CD)=L(DE)=1m, L(EF)=1.5m.	CO203.2
Q6	Draw SFD & BMD for the beam shown below. 	CO203.2
Q7	Draw SFD & BMD for the beam ABCDE, simply supported at A &D, carries a U.D.L. of 20 KN/m from A to B; a point load of 20 KN at E and a clockwise moment of 40KNm at C. Take AB=2m, BC=CD=1.5m and DE=1m.	CO203.2
Q8	Draw SFD & BMD for the simply supported beam of span 4 m supports a central point load of 100 KN and a central concentrated moment of 50 KNm (Clock-wise).	CO203.2
Q9	Draw SFD & BMD for the simply supported beam AB 6 m span subjected to distributed load increasing 1500N/m to 4500 N/m from end A to B.	CO203.2
Q10	Draw SFD & BMD for the beam shown below. 	CO203.2

Unit No	3	Unit Title	Torsion and Thin walled cylinders	Planned	5 Hrs

				Hrs.	

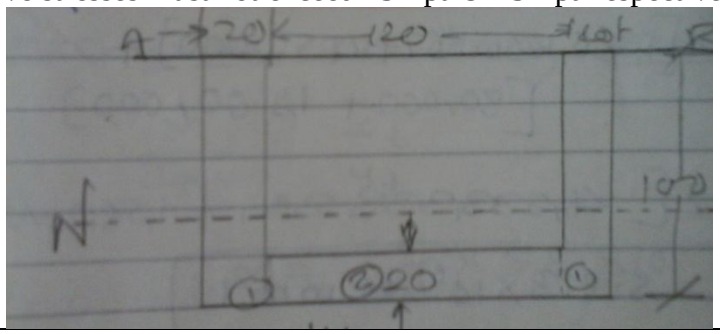
Lesson schedule	
Class No.	Details to be covered
1	Theory of circular shafts & power transmitted.
2	Numericals on shafts.
3	Theory of thin walled cylinders.
4	Numericals on thin walled cylinders.
5	Numericals on thin walled cylinders.

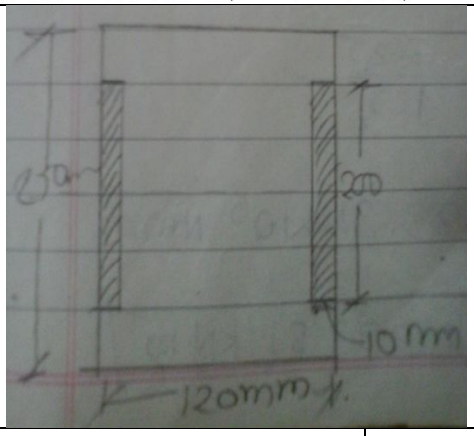
Review Questions		
Q1	Define thin shell.	CO203.3
Q2	What are hoop & longitudinal stresses?	CO203.3
Q3	A steel penstock 1.2m dia., thick., 15mm subjected to 100m head of water. Calculate the hoop & longitudinal stresses at the bottom of the penstock. Take sp.wt. of water 10kN/m^3.	CO203.3
Q4	A pipe of 1 m dia. carrying a fluid under a press. of 15 MPa. Calculate necessary thickness of pipe if max. permissible stress in pipe material is 120Mpa.	CO203.3
Q5	A water pipe 90 cm dia. contains water at press. head of 100m. If the sp. wt. of water is 9810 N/m^3, find the thickness required for water main, if the stress in main is 20 MPa.	CO203.3
Q6	Cylindrical shell 2.8m long, 1000mm dia. & thickness 12 mm is subjected to an internal pressure of 1.5 Mpa. Calculate max. intensity of stress induced & also calculate change in dia., length & volume. Take E=2x10^5Mpa & 1/m=0.3.	CO203.3
Q7	Cylindrical shell 1m long, 180mm internal dia., 8mm thick is filled with fluid at atm. press. if an additional 25,000 mm^3 of fluid is pumped into the cylinder, find the press. exerted on wall of cylinder. Also find the hoop stress induced. Take E=2x10^5Mpa & 1/m=0.3.	CO203.3
Q8	Determine the horsepower transmitted by a shaft if d= 15cm, N=120 rpm, G=8x10^{10}N/m^2& relative angle of twist is 1/120 rad/m. What is the value of maximum shear stress?	CO203.3

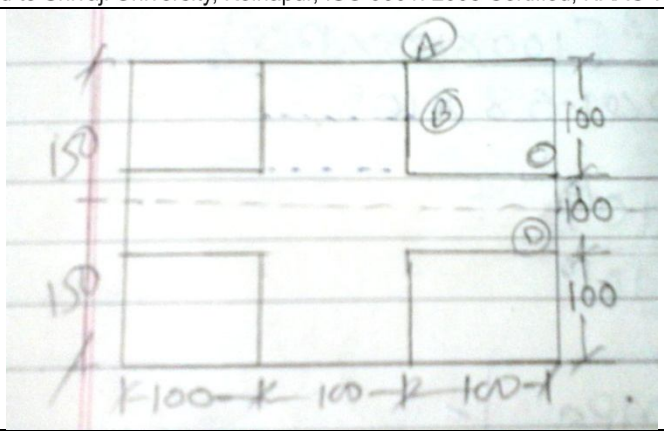
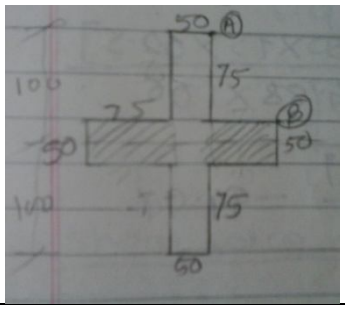
Section II

Unit No	4	Unit Title	Bending stresses	Planned Hrs.	6 Hrs

Lesson schedule	
Class No.	Details to be covered
1	Theory of bending stresses, flectural formula.
2	Numericals on finding bending stresses for the given beam sections.
3	Numericals on finding bending stresses for the given beam sections.

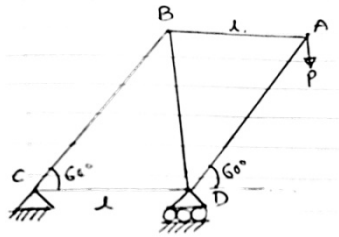
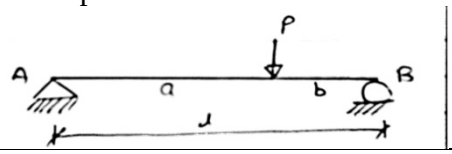
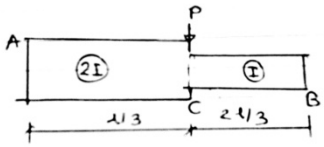
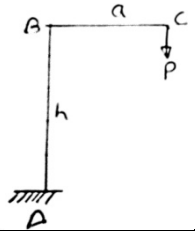
4	Numericals on finding bending stresses for the given beam sections.	
5	Flitched beams or composite beams- Theory & numericals.	
6	Numericals on Flitched beams or composite beams.	
Review Questions		
Q1	Write a note on concept of pure bending.	CO203.4
Q2	What are the assumptions made in the theory of simple bending?	CO203.4
Q3	Derive flexural formula.	CO203.4
Q4	Rectangular beam 150x300mm (deep) is subjected to max. bending moment of 40kNm. Determine the max. bending stresses in the beam if $E=2x10^4$Mpa. Also determine radius of curvature at the point of max. B.M.	CO203.4
Q5	A beam simply supported & carries a udl of 45 kN/m over the whole span. The section of the beam is rectangular having depth as 600 mm. If the max. stress in the material of the beam is 125 N/mm^2& M.I. of the section is $7x10^8mm^4$,find the span of the beam.	CO203.4
Q6	A rolled steel joist of I section has following dimensions: Flange- 250x20 mm , web- 10mm thk. & overall depth- 550mm. If the beam carries a udl of 40kN/m on a span of 8m, calculate the max. stresses due to bending.	CO203.4
Q7	The horizontal beam of section shown in fig. below is 3.5m long & simply supported at its ends. Calculate max. udl that it can carry, if the tensile & compressive stresses must not exceed 25Mpa & 45Mpa respectively. 	CO203.4
Q8	What is flitched beam?	CO203.4
Q9	A 400x400 mm timber is strengthened by the additional steel plates of 400x6.25mm at top & bottom. The composite beam is simply supported at its ends & carries a udl of 30kN/m run on 5m span. Find the max. bending stresses in the steel & timber at the mid span. Take $E_s=2x10^5$MPa & $E_t=0.10x10^5$MPa.	CO203.4

Q10	A flitched beam section consists of 2 wooden joists 120mm wide & 250mm deep strengthened by steel plates of size 10x200mm secured firmly to the sides of timber section as shown in fig. Find the moment of resistance of the section if the permissible stress in timber is 6.25Mpa. Adopt modular ratio of steel as 20. Also calculate f_s.				CO203.4
Unit No	5	Unit Title	Shear stresses in beams	Planned Hrs.	5 Hrs
Lesson schedule:					
Class No.	Details to be covered				
1	Theory of shear stress.				
2	Numericals on finding shear stress distribution for given sections or beams.				
3	Numericals on finding shear stress distribution for given sections or beams.				
4	Numericals on finding shear stress distribution for given sections or beams.				
5	Numericals on finding shear stress distribution for given sections or beams.				
Review Questions					
Q1	Write a note on shear stress.				CO203.5
Q2	A T section has dimensions: Flange- 200x20 mm , web- 10mm thk. & overall depth- 100mm. This section is used as simply supported beam of span 1.5m. Calculate udl that can be applied over the beam such that max. shear stress anywhere in the section is not to exceed $3N/mm^2$. Also determine max. bending stress.				CO203.5
Q3	Find the shear stresses at junctions & plot the distribution for A rolled steel joist of I section having following dimensions: Flange- 250x20 mm , web- 10mm thk. & overall depth- 550mm. Take S.F.=100kN.				CO203.5
Q4	Find shear stresses at junctions A.B,C & D. Also find average shear stress for the section shown below. Take S.F.=200kN.				CO203.5

		
Q5	Laminated wooden beam 200 mm wide & 300 mm deep is formed by 5, 200x60 mm deep wooden planks glud together. The beam is cantilever with 2.5m span. If the allowable shearing stress in the glud joint is 0.75MPa, find the max. point load , beam can carry at the tip of cantilever.	CO203.5
Q6	The c/s as shown in the fig. carries S.F.of 600kN. Draw the shear stress distribution across the section. Find the contribution of the shaded portion of the area in resisting the shear force. 	CO203.5
Q7	Draw the shear stress distribution diagram for the unsymmetrical I section of dimensions : Upper flange-110x25, web-25 thk, lower flange-200x50mm & overall depth-300mm. Take S.F.=500kN.	CO203.5

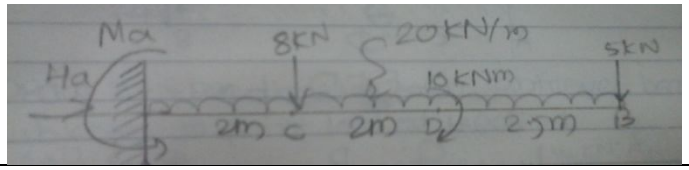
Unit No	6	Unit Title	Strain energy	Planned Hrs.	9 Hrs

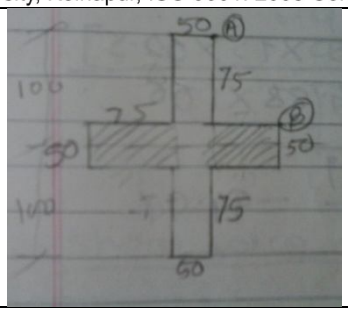
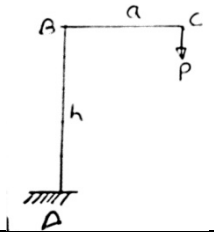
Lesson schedule	
Class No.	Details to be covered
1	Strain energy for impact loading-Theory.
2	Numericals on impact loadings.
3	Truss- Theory & numericals on finding vertical & horizontal deflection.
4	Numericals on finding vertical & horizontal deflection of the truss.
5	Castiglano's first theorem- theory & numericals related to the truss.
6	Numericals on finding the deflection of beams by strain energy method.

7	Numericals on finding the deflection of beams by strain energy method.	
8	Numericals on finding the deflection of bents by strain energy method.	
9	Numericals on finding the deflection of bents by strain energy method.	
Review Questions		
Q1	What is mean by strain energy?	CO203.6
Q2	State & explain Castiglano's first theorem.	CO203.6
Q3	The 50kN axial tensile force is suddenly applied to a steel rod 2m long & 1000mm^2 c/s area. Determine the strain energy absorbed by the steel rod.	CO203.6
Q4	A collar rigidly attached to the end of a vertical bar is subjected to a falling weight through 10mm. The bar is 3m long & 600mm^2 area. If the max. instantaneous elongation of the bar is 0.2cm, determine stress developed in the bar & amount of weight.	CO203.6
Q5	Find vertical deflection of A of the structure shown below. All members have same c/s area. 	CO203.6
Q6	Calculate deflection under point load for beam shown in fig. below. 	CO203.6
Q7	Calculate deflection under point load for beam shown in fig. below. 	CO203.6
Q8	For the cantilever bent ABC shown in fig. find vertical & horizontal deflection at point C by using strain-energy method. 	CO203.6

Model Question Paper

Course Title :	Structural Mechanics-I	
Duration:3 Hrs		Max.

			Marks 100
		Instructions:1)All questions are compulsory. 2) Use of calculator is allowed. 3) Assume suitable data wherever necessary.	
		Section-I	
1	A	What is principle of superposition?	4
	B	The tensile test was conducted on M.S.bar. The following readings were observed, 8. Dia. Of bar=3cm 9. Gauge length=20cm 10. Load at elastic limit=250kN 11. Extension at load of 150kN=0.21mm 12. Max. load=380kN 13. Total extension=60mm 14. Dia. Of rod at failure=2.25cm. Find: Young's modulus, stress at elastic limit,% elongation & % decrease in area.	12
2	A	State importance of point of contraflecture.	4
	B	Draw SFD & BMD for the beam shown below. 	12
3	A	What are hoop & longitudinal stresses?	6
	B	Cylindrical shell 1m long, 180mm internal dia., 8mm thick is filled with fluid at atm. press. if an additional 25,000 mm^3 of fluid is pumped into the cylinder, find the press. exerted on wall of cylinder. Also find the hoop stress induced. Take $E=2x10^5$Mpa & 1/m=0.3.	12
		Section-II	
4	A	Derive flexural formula.	6
	B	A rolled steel joist of I section has following dimensions: Flange- 250x20 mm , web- 10mm thk. & overall depth- 550mm. If the beam carries a udl of 40kN/m on a span of 8m, calculate the max. stresses due to bending.	12
5	A	Write a note on shear stress.	6
	B	The c/s as shown in the fig. carries S.F.of 600kN. Draw the shear stress distribution across the section. Find the contribution of the shaded portion of the area in resisting the shear force.	

			12
6	A	State & explain Castiglano's first theorem.	4
	B	For the cantilever bent ABC shown in fig. find vertical & horizontal deflection at point C by using strain-energy method. 	12

Assignments

List of experiments/assignments to meet the requirements of the syllabus	
Experiment No.	Name of the experiment (Any 7 should be perform)
1	Study of Universal Testing Machine
2	Tensile test on Mild steel and TMT steel
3	Compression test on M.S. and C.I, cement bricks or paving blocks
4	Compression test on timber
5	Direct shear test on M.S
6	Charpy or Izod Impact test on different metals
7	Bending test on M.S. bar and Timber
8	Water absorption and compression test on burnt bricks
9	Hardness test on metals
10	Torsion test Mild steel.

Assignment No. 1 to 6

Assignment Title		CO203.1 to CO203.6
Batch I to Batch VIII	All the review questions from unit 1 to unit 6 are supposed to solve as assignments for all batches.	

List of additional assignments /experiments

Assignment No. 1 to 6		
Assignment Title		CO
All batches	All the practice tests, unit tests I & II, Prelim etc papers/tests should be solved by the students as extra assignment.	

Lab Plan

List of experiments/assignments to meet the requirements of the syllabus		
Experiment No	Experiment Title	CO
1	Study of Universal Testing Machine.	CO203.1
2	Tensile test on Mild steel and TMT steel.	CO203.1
3	Compression test on M.S. and C.I, cement bricks or paving blocks	CO203.1
4	Compression test on timber.	CO203.1
5	Direct shear test on M.S.	CO203.4
6	Charpy or Izod Impact test on different metals.	CO203.6
7	Bending test on M.S. bar and Timber.	CO203.4
8	Water absorption and compression test on burnt bricks.	CO203.1
9	Hardness test on metals.	CO203.1
10	Torsion test Mild steel.	CO203.3
Assignment No. 1		
Batch I	1) Draw the fig. of UTM and explain the different parts. 2) Explain neck formation in M.S.bar tested for tensile loading. 3) Draw the stress-strain curve for TMT bar.	CO203.1
Batch II	1) Explain the effect of compression load on different material. 2) Draw the shape of test specimen after compression load. 3) Explain the significance of testing of timber specimen for compression load.	CO203.1
Batch III	1) Explain the effect of shearload on M.S. material. 2) Draw the shape of test specimen after shear load and torsion load on material 3) Explain the significance of testing of material for shear and torsion load.	CO203.3 CO203.4
Assignment No. 2		
Batch I	1) Explain the significance of water absorption and compression test on bricks. 2) Write a note on different properties of materials. 3) Define hardness of material and explain procedure to find hardness of material.	CO203.1
Batch II	1) Explain strain energy and in list different formulas' to find strain energy for different cases. 2) Significance of charpy and izod test. 3) Draw the fig .of test specimen for chapry and izod test.	CO203.6

Batch III	1)draw the bending stress shape and shear stress shape for I-section ,C- section. 2) Explain bending test for M.S.bar. 3) Explain shear test on timber material.	CO203.4

Course Plan for Building construction and materials

Course Code	CE 204	Course	Building construction and materials
Prepared by	Mr. S. B. Kore, Mr. S. B.patil	Date	25/05/2018
Prerequisites	This course requires the student to know about the basic materials used for construction and use of all the components of building.		
Course Outcomes			
At the end of the course the students should be able to:			
CO204.1	**Know**[1] the building Materials.		
CO204.2	**Describe**[1] properties and suitability of various building materials.		
CO204.3	**State**[1] the different building components.		
CO204.4	**Demonstrate**[3] different bonds in brick masonry.		
CO204.5	**Produce**[3] drawings of different building components.		
CO204.6	**Explain**[2] different types of roof coverings.		
CO204.7	**Describe**[1] different types of flooring.		

Mapping of COs with POs

POs / COs	a	b	c	d	E	f	G	h	i	j	k	l
CO204.1			2							1	2	
CO204.2			1							1	3	
CO204.3			1									
CO204.4		1	2		2							
CO204.5		3										
CO204.6											1	
CO204.7											1	

Course Contents

Unit No.	Title	No. of Hours
	Section I	
1.	Engineering properties and use of following materials. Stones – Requirements of good building stone, uses of building stones. Bricks – Manufacturing, Types(clay bricks, fly ash, cellular light weight concrete brick, aerated cement concrete brick or autoclave brick) and Engineering Properties. Aggregates - Fine Aggregates and coarse aggregates - Origin, types, particle size and shape, mechanical and physical properties, artificial sand.	

	Timber – Natural and Artificial wood and their application in Civil Engineering. Steel – Standard structural sections, steel as reinforcement. High Yield Strength Steel and high tensile steel, uses of steel in Building Construction. Cement- types. Tiles - Ceramic, Vitrified, Natural Stone, Paving Blocks etc. Miscellaneous – Aluminium, Glass, Plastic, Admixtures: chemical (plasticiser and super plasticisers), Minerals (fly ash, microcilica).	8
2.	Basic requirements of a building as a whole: strength and stability, Dimensional stability, comfort and convenience, damp prevention, water-proofing techniques, heat insulation, day lighting and ventilation. Sound insulation and anti termite treatment. Building components and their basic requirements : Foundations, plinth, walls andcolumns in superstructure, floors, doors and windows, sills, lintels and weather sheds,roofs, steps and stairs, utility fixtures. Formwork: materials (wooden, steel and aluminium). Foundations: Types and their suitability (Stepped, isolated, combined, strip, raft, strap or cantilever, pile.)	6
3.	Stone masonry – Random Rubble, Uncoursed Rubble, Coursed Rubble and Ashlar Masonry. Brickwork and Brick Bonds - English, Flemish, Rat trap bond (one brick thick). Composite masonry, various partition walls, brick, aluminiumand timber	4
	Section II	
4.	Arches: Arches and their stability consideration, technical terms in arches,types of arches,methods of construction. Lintel: Necessity, Materials: wood, stone, brick, steel, R.C.C. and reinforcedbrick lintels. Doors – Classification, T.W. Paneled Door, Flush Door, Aluminum Glazed Doors, Steel Doors, fixtures and fastening. Windows - Classification, T.W. Glazed Windows, Aluminum Glazed Windows, SteelWindows, fixtures and fastening.	6
5.	Stairs: Technical terms, requirements of a good stair, uses, types, materials for construction. Design of stairs (Dog Legged, quarter turn and Open Well), Ramps, lifts and escalator	5
6.	Roofs and Roof coverings: Terms used. Roof and their selection, pitched roofs and their types, Steel Trusses types and their suitability, roof covering, material, details, fixtures- manglore tiles, A. C., G. I. and Precoated sheets, concept of proflex (truss less) roof and their selection. Concrete Flooring (Tremix Flooring) Construction of upper floors: R.C.C. slabs, R.C.C. beams and slab. Flat slab floor.	7

	Waterproofing:materials, methods and systems.	

Reference Books:

Sr. No.	Title of Book	Author	Publisher/Edition	Topics
1.	Building Construction	B.C.Punmia	Laxmi Publications	3,4,5,6
2.	A Text Book of Building Construction	S.P. Arora, S.P. Bindra	DhanpatRai Publications	All
3.	Basic Civil Engineering	G. K. Hiraskar	DhanpatRai Publications	1 and 2
4.	Engineering Materials	R.K.Rajput	S. Chand	1
5.	Building drawing	Chakraborty		4,5,6

Scheme of Marks

Section	Unit No.	Title	Marks
I	1	Engineering properties and use of materials.	22
	2	Basic requirements of building as a whole.	22
	3	Brick and stone masonry.	22
II	4	Doors and widow.	25
	5	Staircase.	25
	6	Roofing and roof covering.	25

Examination scheme

Examination Scheme	Theory	Term Work	OE	Total
Max. Marks	100	50	--	150
Contact Hours/ week	3	2s	--	05

Course Unitization

CO	Evaluation	Notes
CO204.1	CAT 1	3 questions with mixing of sub questions from chapters 1,2
CO204.2		
CO204.3	CAT 2	3 questions with mixing of sub questions from chapters 1,2
CO204.4		
CO204.5	Quiz/Oral/Exit survey	Solve any three
CO204.6		
CO204.7		

Evaluation scheme

Examination Scheme	Theory	Term Work	POE	Total
Max. Marks	100	50	--	150
Contact Hours/ week	3	2	--	5
Prepared by	Ms. Patil S. S.		Date	

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Engineering properties and use of materials	Planned Hrs.	8
Lesson schedule					
Class No.	Details to be covered				
1	Requirement and use of stone.				
2	Types of bricks and manufacturing process of bricks.				
3	Aggregates and their particle size.				
4	Natural and artificial timber and their uses.				
5	Standard structural section of the steel.				
6	Types of cement.				
7	Various types of tiles.				
8	Other construction materials like plastic, glass etc.				

Review Questions		
Q1	What are the characteristics of good building stone? Give the uses of marble and sand stone in construction.	CO204.1
Q2	What are the characteristics of first class brick? How will you test the quality of bricks?	CO204.1
Q3	What is coarse aggregate? What are the different kinds of it used in making concrete?	CO204.1
Q4	Give the names and uses of any three types of cement other than Portland cement.	CO204.1
Q5	What is the necessity of curing for concrete? Explain any one method for curing.	CO204.1
Q6	Write a short note on use of steel in building construction.	CO204.1

Unit No	2	Unit title	Basic requirement of a building as a whole	Planned Hrs.	6

Lesson schedule	
Class No.	Details to be covered
1	Basic requirement of a building such as strength and stability, comfort and convenience.
2	All techniques for the building such as water proofing, heat insulation etc.
3	Building components and their basic requirements.
4	Materials used for formwork.
5	Types of foundation.
6	Suitability of foundation.

Review Questions		
Q1	Brief the various factors which influence cay lighting and ventilation as a requirement in residential building.	CO204.2
Q2	Write a short note on load coming over a building.	CO204.2
Q3	What are the basic requirements of a building as a whole?	CO204.2
Q4	Explain the function of foundation. Explain any one type of foundation.	CO204.2
Q5	Write a short note on requirements of formwork.	CO204.2

Unit No	3	Unit Title	Stone and brick masonry	Planned Hrs.	4

Lesson schedule	
Class No.	Details to be covered
1	Rubble stone masonry.
2	Ashlar stone masonry.
3	Brick work and brick bond.
4	Various partition walls.

Review Questions		
Q1	Compare English bond add Flemish bond with neat sketch.	CO204.3
Q2	Write a short note on types of mortar.	CO204.3
Q3	Draw a cross section of stone masonry wall and show string course, corbel, through stone, parapet, DPC, sill and lintel.	CO204.3
Q4	What is the significance of bonding in brickwork? Explain by sketches.	CO204.3

Section II

Unit No	4	Unit Title	Doors and Windows	Planned Hrs.	6

Lesson schedule	
Class No.	Details to be covered
1	Arches and their suitability.
2	Necessity of lintels.
3	Classification of doors.
4	Design of doors.
5	Classification of window.
6	Design of window.

Review Questions		
Q1	Draw to a scale the plan, elevation and section of T.W. paneled door from following data: Clear opening-1000*2100 mm frame size-75*125 mm Style-125*40 mm top rail and bottom rail-125*40 mm Lock rail-150*40 mm No. of panels-4 No. of shutters-2 Show different fixture.	CO204.3
Q2	Write a short note on arches and lintels.	CO204.3

Unit No	4	Unit Title	Staircase	Planned Hrs.	5

Lesson schedule	
Class No.	Details to be covered
1	Technical terms required for staircase.
2	Types of staircase.
3	Design of dog legged staircase.
5	Design of open well staircase.

Review Questions

Q1	Write a short note on staircase.	CO204.4
Q2	Design a R.C.C dog legged staircase for a residential building with suitable scale. The distance between the floors is 3 m. The stair hall size is 2m*4m. Draw plan and section. Assume suitable data wherever necessary. Write the design steps.	CO204.4
Q3	Write a short note on ramps and escalator.	CO204.4

Unit No	4	Unit Title	Roof and roof covering	Planned Hrs.	7

Lesson schedule

Class No.	Details to be covered
1	Terms used in roof covering.
2	Types and their selection.
3	Design for truss.
4	Concrete flooring.
5	Construction of upper floors.
6	Water proofing materials.
7	Systems for water proofing.

Review Questions

Q1	Which are the techniques for water proofing?	CO204.4
Q2	Write a short note on truss.	CO204.4

Model Question Paper

Course Title :		Building construction and materials.	
Duration- 4 Hrs.			Max. Marks 100

Instructions:

1	Q1. is compulsory.
2	Attempt any two questions from the remaining in section-I
3	Use full imperial sheet for section-II
4	Mention any data assumed wherever necessary.

Section-I

			Marks
1	a	Draw: 1. Trapezoidal combined footing 2. Strap footing.	10
	b	Compare English bond and Flemish bond with neat sketch.	8
2	a	Show the components of a building with the help of neat sketch.	8

	b	Explain the basic requirement of a building.	8
3	a	What do you understand by formwork? State the requirements of good formwork.	8
	b	Explain the function of foundation. Explain any one type of foundation.	8
4	a	Write a note on 1. Ashlar masonry. 2. Requirements of good building stone. 3. Properties of plain cement concrete. 4. Composite masonry.	16
Section-II			
			Marks
5	a	Draw to a scale of 1:10, the sectional plan and elevation of a T.W. framed and paneled door having two shutters. Data: Clear opening:1000*1200mm Frame size:100*75 mm Style:65*35 mm	25
2	a	Design and draw plan and section of R.C.C dog legged stair for a school building having floor height of 4 m and stair width of 2 m. assume suitable data.	25

Assignments

List of experiments/assignments to meet the requirements of the syllabus		
Assignment No. 1		
Assignment Title	Foundation	CO204.3
All batches	Q1. Draw the sketch showing all types of foundation with reinforcement details.	
Assignment No. 2		
Assignment Title	Stone masonry	CO204.4
All batches	Q1. Draw the sketch showing UCR, Course rubble and ashlar masonry. Q2. Show the English bond and Flemish bond in brick masonry with all details.	
Assignment No. 3		
Assignment Title	Doors and windows	CO204.5
All batches	Q1. Draw to a scale 1:10 the plan, elevation and section of T.W. framed and fully glazed window from following data: Clear opening-900*1200 mm frame size-100*65mm Style-65*35 mm top rail and bottom rail-65*35 mm Intermediate rail-65*35 mm No. of shutters-2 Show different fixture.	

	Q2. Draw to a scale of 1:20, the sectional plan and elevation of a T.W. framed and paneled door having two shutters. Data: Clear opening:900*2100mm top and bottom rail-125*40mm Frame size:125*75 mm lock rail-150*35 mm Style:125*40 mm no. of panels-6 No. of shutters-2	
Assignment No. 4		
Assignment Title	Staircase	CO204.5
All batches	Q1. Design and draw plan and section of R.C.C dog legged stair for a school building having floor height of 3 m and stair width of 0.9 m, staircase size 2*4.5 m. Assume suitable data. Q2. Design and draw to a scale 1:10 plan and sectional elevation of a RCC quarter turn stair having a landing of 1000*1000 mm size. The height to be negotiated is 3150mm. write design steps and show railing details.	
Assignment No. 5		
Assignment Title	Roof covering	CO204.6
All batches	Q1. Draw to a scale 1:20 the details of wooden king post truss from following data: 1. Clear span-6000 mm 2. c/s of tie beam- 100*240 mm 3. c/s of king post-75*100 mm 4. c/s of principle rafter-100*100 mm 5. c/s of strut-50*90 mm 6. c/s of purlin-120*200 mm 7. c/s of common rafter-50*90 mm 8. c/s of ridge piece-50*175 mm 9. c/s of battens-40*25 mm 10. slope of principle rafter-2H:1V Q2. Draw to a scale the details of wooden queen post truss from following data: 1. Clear span-13 m 2. Wall thk-350 mm 3. c/s of tie beam- 150*220 mm 4. c/s of queen post-150*150 mm 5. c/s of principle rafter-120*150 mm 6. c/s of strut-100*120 mm 7. c/s of purlin-120*200 mm 8. staining beam-80*150 mm 9. staining sill-60*150 mm 10. c/s of common rafter-80*100 mm 11. c/s of battens-30*50 mm 12. slope of principle rafter-30	

Course Plan for Fluid Mechanics-I

Course Code	CE 205	Course	Fluid mechanics-I
Prepared by	Dr A. D. Katdare	Date	18/05/2018
Prerequisites	This course requires the student to know about the basic concepts regarding fluid mechanics & kinetics and kinematics.		
Course Outcomes			
At the end of the course the students should be able to:			
CO205.1	**Recognize**[2] the processes and science of fluids.		
CO205.2	**Explain**[2] the basic properties of fluids and their behavior under application of various force systems.		
CO205.3	**Discuss**[2] the basic concepts and principles in fluid statics, fluid kinematics and fluid dynamics with their applications in fluid flow problems.		
CO205.4	**Identify**[4] and obtain values of fluid properties and relationship between them		
CO205.5	**Demonstrate**[3] the principles of continuity, momentum and energy as applied to fluid in motion.		
CO205.6	**Recognize**[2] the principles written in form of mathematical equations and to **Apply**[3] these equations to **Analyze**[4] problems by making proper assumptions and learn systematic engineering methods to solve practical fluid mechanics problems.		

Mapping of COs with POs

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
CO205.1		2	2				1			2		2
CO205.2	2				2				2		3	
CO205.3		3		3		1		3		3		
CO205.4			2				2					2
CO205.5	3			2					3		2	
CO205.6		3			3	3		3				2

Course Contents

Unit No.	Title	No. of Hours
	Section I	
1.	A. Introduction: Physical Properties of Fluids (Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity: Dynamic and Kinematic Viscosity, Compressibility, Surface tension,	6

	Capillary Effect, Vapour Pressure and Cavitation), Newtons law of viscosity, Types of Fluids. B. Dimensional Analysis: Dimensions and Dimensional Homogeneity, Importance and Use of Dimension Analysis, Buckingham's Pie Theorem, Dimensionless Numbers and Model Laws.	
2	A. Fluid Statics: Types of Pressure, Pascal's Law, Hydrostatic Law, Pressure Measurement Devices, Pressure Head, Pressure Diagram, Centre of Pressure, Forces on Plane and Curved Surfaces. B. Buoyancy and Floatation: Archimedes's Principle, Metacentre, Stability of Submerged and Floating Bodies.	7
3	Fluid Kinematics: Types of Flows, Stream lines, Equipotential lines, Steak Line, Path Line, Stream Tube, Stream Bundle, Stream Function and Velocity Potential Function, Flow Net-(Properties and Uses), Continuity Equation (3-D Cartesian Form).	5
SECTION II		
4.	A. Fluid Dynamics: Forces Acting on Fluid in Motion, Euler's Equation along a Streamline, Bernoulli's Theorem, Limitations. B. Bernoulli's Applications: Venturimeter (Horizontal andVertical), Orificemeter, Orifices, Time required for Emptying the Tank, Concept of HGL and TEL	6
5.	A. Laminar Flow and Turbulent Flow: Reynold's Experiment, Hazen Poisulle's Equation for Viscous Flow through Circular Pipes, Prandtl Mixing Length Theory, Darcy-Wiesbach Equation, Introduction to Moody's Chart. B. Boundary Layer Theory: Concept, Various Thicknesses (Nominal, Displacement, Momentum, Energy), Hydraulically	6

	Smooth and Rough Boundaries, Separation of Boundary Layer, Control of Separation.	
6.	A. Losses in Pipes: Major and Minor Losses, Concept of Equivalent Pipe, Dupit's Equation. B. Pipes in Series, Parallel and Syphon, Two Reservoir Problems, Concept of Water hammer. Surge Tanks (Function, Location and Uses).	6

Reference Books:

Sr. No.	Title of Book	Author	Publisher/Edition	Topics
01	Fluid mechanics & hydraulics	R. K. Bansal	Khanna publications	ALL
02	Fluid mechanics & hydraulics	B.C. Punmia,Jain	Laxmi Pubilcations	ALL
03	Fluid mechanics & hydraulics	MODI/SETH	Standard publications	ALL
04	Fluid Mechanics	Garde Mirajgaonkar	Tata Mcgraw Hill	ALL
05	Fluid Mechanics Through Problems	Dr. R. J. Garde	Tata Mcgraw Hill	ALL

Evaluation scheme

Examination Scheme	Theory	Term Work	POE	Total
Max. Marks	100	25	25	150
Contact Hours/ week	3	2	--	5

Scheme of Marks

Section	Unit No.	Title	Marks
I	1	Fluid mechanics	18
	2	Fluid statics	16
	3	Fluid kinematics	16
II	4	Fluid dynamics	18

	5	Laminar and Turbulent Flow	16
	6	Losses In Pipes	16

Course Unitization

Section	Unit		Course Outcomes	Mode of Assessment
	No.	Title		
I	1	Fluid mechanics	**CO205.1**	CAT –I Q. 1,2,3
	2	Fluid statics	**CO205.2**	
	3	Fluid kinematics	**CO205.3**	CAT –II Q. 1,2,3
II	4	Fluid dynamics	**CO205.4**	
	5	Laminar and Turbulent Flow	**CO205.5**	Class Test, Quiz
	6	Losses In Pipes	**CO205.6**	

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Physical Properties Of Fluids	Planned Hrs.	06
Lesson schedule					
Class No.	Details to be covered				
1	Physical properties of fluids (density, specific Weight, specific volume, specific Gravity, Viscosity: Dynamine and kinematic Viscosity.				
2	Compressibilty, surface tension, capillary effect, vapour pressure and cavitation).				
3	Newtons law of viscosity, types of fluids.				
4	Dimensions and Dimensional homogeneity.				
5	Importance and use of Dimension analysis, Buckingham’s pie theorem.				
6	Dimensionless Numbers and model laws.				
Review Questions					
Q1	Explain Physical properties of fluids				**CO205.1**
Q2	Define Dimensions and Dimensional homogeneity.				
Q3	Describe Newtons law of viscosity				
Q4	Enlist & explain types of fluids				
Q5	What are the Dimensionless Numbers and model laws.				

Section I					
Unit No	2	Unit Title	Fluid Statics	Planned	07

				Hrs.	
Lesson schedule					
Class No.	Details to be covered				
1	Types of Pressure, Pascal' s Law				
2	Hydrostatic Law				
3	Pressure Measurement Devices, pressure Head				
4	Pressure Diagram, Center of pressure				
5	Force of Plane and Curved Surfaces				
6	Archimede's principle, Metacentre				
7	Stability of Submerged and Floating Bodies				
Review Questions					
Q1	Define Pascal' s Law and Hydrostatic Law				**CO205.2**
Q2	Explain the Archimede's principle.				
Q3	Write note on Pressure Diagram and Center of pressure				
Q4	How will you check Stability of Submerged and Floating Bodies				
Q5	What are the different Types of Pressure?				
Section I					
Unit No	3	Unit Title	Fluid Kinematics	Planned Hrs.	05
Lesson schedule					
Class No.	Details to be covered				
1	Types of Flows Stream lines				
2	Equipotential lines, stream line,				
3	path line, Stream Tube				
4	Stream Bundle, stream Function and Velocity Potential Function				
5	Flow Net – (Properties and Uses) continuity Equation				
Review Questions					
Q1	What is Flows Stream lines?				**CO205.3**
Q2	What is continuity Equation?				
Q3	What is the Stream Bundle, stream Function and Velocity Potential Function\?				
Q4	What are Properties and Uses of Flow Net ?				
Section II					
Unit No	4	Unit Title	Fluid Dynamics	Planned Hrs.	06
Lesson schedule					
Class No.	Details to be covered				

1	Forces Acting on fluid in motion	
2	Euler's Equation along a streamline	
3	Bernoulli's Theorem, limitations	
4	Venturimeter (Horizontal and vertical) Orifice meter , Orifices	
5	Time Required for Emptying the Tank	
6	Concept of HGL and TEL	
Review Questions		
Q1	Give Forces Acting on fluid in motion	**CO205.4**
Q2	Write the equation for Time Required for Emptying the Tank	
Q3	Explain Concept of HGL and TEL	
Q4	Explain Venturimeter (Horizontal and vertical) Orifice meter and Orifices.	
Q5	Write a Euler's Equation along a streamline	
Q6	State and explain Bernoulli's Theorem & its limitations	

Section II					
Unit No	5	Unit Title	Laminar Flow and Turbulent Flow	Planned Hrs.	06

Lesson schedule		
Class No.	Details to be covered	
1	Reynolds's Experiment, Hazen poisulle's equation for viscous flow through circular pipes	
2	Prandtl mixing length theory	
3	Darcy- wiesbach equation, introduction to moody's chart	
4	Concept,various thicknesses (nominal , displacement, momentum, energy)	
5	Hydraulically smooth and rough boundaries	
6	Separation of boundary layer , control of separation	
Review Questions		
Q1	Define moody's chart	**CO205.5**
Q2	Explain the Hazen poisulle's equation for viscous flow through circular pipes	
Q3	Write note on Prandtl mixing length theory	
Q4	Derive the expression for Darcy- wiesbach equation	
Q5	Derive the expression for Hydraulically smooth and rough boundaries	
Q6	Write Separation of boundary layer theory	

Section II					
Unit No	6	Unit Title	Losses In Pipes	Planned Hrs.	06
Lesson schedule					

Class No.	Details to be covered	
1	Major and minor losses	
2	Concept of equivalent pipe	
3	Dupit's equation	
4	Pipes in series, parallel and siphon	
5	Two reservoir problems	
6	Concept of water hammer, surge tanks	
Review Questions		
Q1	Define Concept of equivalent pipe	**CO205.6**
Q2	Explain the various Major and minor losses	
Q3	What is mean by Pipes in series, parallel and syphon	
Q4	State & explain Dupit's equation	
Q5	What is the design of surge tanks?	

Model Question Paper

		SECTION I	
Q.1	**a**	What is viscosity of fluid? How & why does it vary with temperature? Give its units.	**5**
	b	What do you mean by dimensional homogeneity? Define Reynold's no.& Froude no. State their significance in Fluid mechanics.	**5**
	c	State the minimum diameter of glass tube to be immersed in water, for which capillary effects are to be limited upto 2.98 mm. Take surface tension of water in contact with air as 0.073 N/m. Prove the formula used	**5**
	d	A vertical gap of 25 mm of infinite extent contains oil of specific gravity 0.95 and viscosity 2.5 N-s/m^2. A square metal plate of 1.5 m side and 1.5 mm thick weighing 50 N is to be lifted through the gap and at a constant speed of 0.1 m/s. Estimate the force required?	**5**
Q.2	**a**	A rectangular plate 3 m long and 1m wide is immersed vertically in water in such a way that its longer side is parallel to the water surface and is 1.5 m below it. Determine the total force on the plate and the position of the center of pressure.	**7**
	b	What are the types of equilibrium and conditions of stability for floating objects and Explain in brief the laboratory procedure to determine the metacentric height.	**8**

Q.3	**a**	Define: Stream line and equipotential line. Show that these lines intersect each other orthogonally	**7**
	b	Derive continuity equation in differential form for a 3-D, steady, incompressible flow	**8**
Q.4	**a**	Examine whether the velocity components given by: $u = - 4ax (x2-3y^2)$ and $v = 4ay (3x^2-y^2)$ represent a physically possible two dimensional flow; if so, whether the flow is rotational or irrational?	**7**
	b	Briefly explain the procedure of computing the resultant hydrostatic forces on a curved surface	**8**
		SECTION II	
Q.5	**a**	Draw a neat sketch of venturimeter? Explain the function of each component part.	**5**
	b	Write a short note on : Reynold's Experiment	**5**
	c	Determine the difference in elevation between water surfaces of two reservoirs which are connected by a horizontal pipe of diameter 45 cm and length 10 m. The discharge through the pipe is 500 lps. Consider all losses and assume $f = 0.035$.	**5**
	d	What are the causes of separation of boundary layer and how can separation be controlled?	**5**
Q.6	**a**	State Bernoulli's equation. List out the assumptions and limitations of Bernoulli's equation. How it is modified while applying in practice?	**8**
	b	Write short note on: Pipes in series and in parallel.	**7**
Q.7	**a**	Two reservoirs open to atmosphere are connected by a pipe of 30 cm diameter and 1000 m long. The pipe goes over a hill whose height is 3 m above the level of water in the upper reservoir. The difference in water levels in the two reservoirs is 12 m. If the absolute pressure of water anywhere in the pipeline is not allowed to fall below 2.5 m of water in order to prevent vapour pressure formation. Find the length of pipe in the portion between the upper reservoir and the hill summit. Also compute the rate of flow through the pipe. Assume Darcy's friction factor as 0.02	

		and neglect bend losses only. Take atmospheric pressure head = 10.3 m of water.	**8**
	b	Two reservoirs are connected by two pipes in series of lengths 200 m and 300 m of diameters 20 cm and 30 cm respectively. The difference of head between the two surfaces is 10 m. The friction factors for the two pipes are 0.02 and 0.015 respectively. Determine the flow rate.	**7**
Q.8	**a**	Derive Hagen-Poiseuille equation for steady laminar flow in pipes. Further establish relation between Darcy Weisbach friction factor and Reynold's number in laminar flow	**10**
	b	Calculate the power required to maintain a laminar flow of an oil of viscosity 10 poise through a pipe 100 cm diameter at the rate of 10 lps if the length of pipe is 1 km.	**5**

Lab Plan

List of experiments to meet the requirements of the syllabus		
Assignment Title	List of experiments	**CO305.1 CO305.2 CO305.3**
Batch I to IV	Study of Pressure Measuring Devices	
	Calibration of Measuring Tank	
	Measurement of Discharge	
	Determination of Metacentric Height for Floating Bodies	
	Verification of Bernoulli's Theorem	
	Calibration of Venturimeter	
	Calibration of Orificemeter	
	Determination of Hydraulic Coefficients of Orifice	
	Reynold's Experiment	

	Determination of Friction Factor for Given Pipe.

Assignment other than Syllabus
Assignment on each unit from SUK Question paper

Course Plan for Numerical Methods

Course Code	CE 206	Course	Numerical Methods
Prepared by	Dr. N. K. Patil	Date	25/05/2017
Prerequisites	This course requires the student to know about the basic concepts regarding mathematics and computer programming.		
Course Outcomes			
At the end of the course the students should be able to:			
CO206.1	**develope**[1] Solution of Nonlinear and Transcendental equations		
CO206.2	**Develope**[4] a programme to solve a problem		
CO206.3	**Perform**[4] numerical differentiation and integration		
CO206.4	**solve**[3] System of simultaneous algebraic equations		
CO206.5	**solve**[3] ordinary differential equations		
CO206.6	**Apply**[5] numerical methods to solve civil engg. applications		

Mapping of COs with POs

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
CO206.1			2				1			2		2
CO206.2	2										3	
CO206.3												
CO206.4			2									
CO206.5	3											
CO206.6		3						3				

1 mild 2 moderate 3 strong

Course Contents

Unit No.	Title	No. of Hours
	Section I	
1.	Solution of Nonlinear and Transcendental equations: Basic concepts on polynomial equations, Roots of equations by Bisection method, Iterative method, Regula falsi method, Newton Raphson method, Secant method.	03
2	Numerical Interpolation: Least square curve fit and trigonometric approximations, Finite differences and difference operators, Newtons interpolation formulae, Gauss forward and backward formulae, Sterling, Bessel's and Evertte's formulae, Interpolation with unevenly space data	03

	points-Lagrange's interpolation	
3	Numerical differentiation and integration: Numerical differentiation, errors in numerical differentiation, Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules, Romberg integration-recursive formulae, Evaluation of double integrals by Trapezoidal and Simpson's rules	04
SECTION II		
4.	System of simultaneous algebraic equations Matrix inversion and solution of transcendental and system of algebraic equations-Gauss elimination method, Jacobi's method and Gauss-Seidal method, Eigen values and Eigen vectors, Jacobi's method.	04
5.	Ordinary differential equations: Euler's method, Modified Euler's method, Runge Kutta methods of 2nd and 4th order.	04
6.	Applications to Civil Engg.: problems Formulation of various problems of Civil Engineering , Calculation of slope & design of a beam, Seepage and development of flow nets, consolidation of soil layer, head loss due to friction, water supply pipe network etc. and development of computer programmes	06

Reference Books:

Sr. No.	Title of Book	Author	Publisher/Edition	Topics
01	Numerical methods in engineering and science	Grewal, B.S.	Khanna Publishers, Delhi.	ALL
02	Numerical methods in science and engineering : a practical approach	Rajasekaran , S	Wheeler Publishing, New Delhi	ALL
03	Object Oriented programming in C++,	Lafore,Robert	Techmedia, Delhi	ALL
04	Object oriented programming with C++	Balagurusamy,E	Tata McGrawHill, New Delhi	ALL
05	Applied Numerical Methods for Engineers and Scientists	Rao, S. S.	Prentice-Hall, 2002	ALL
06	Computational engineering: introduction	Schafer,Michael	Springer, Verlag, Berlin	ALL

	to numerical methods			
07	Numerical Methods for Engineers	Chapra, S. C. and Canale, R. P.	McGraw-Hill, 6th Ed., 2009	ALL

Examination scheme

Examination Scheme	Theory	Term Work	POE	Total
Max. Marks	--	50	--	50
Contact Hours/ week	02	02	--	04

Unit wise Lesson Plan

Section I					
Unit No	1	Unit Title	Solution of Nonlinear and Transcendental equations	Planned Hrs.	03
Lesson schedule					
Class No.	Details to be covered				
1	Solution of Nonlinear and Transcendental equations				
2	Roots of equations by Bisection method				
3	Regula falsi method				
4	Newton Raphson method				
5	Secant method				
Review Questions					
Q1	Explain Solution of Nonlinear and Transcendental equations				**CO206.1**
Q2	Calculate Roots of equations by Bisection method				

Section I					
Unit No	2	Unit Title	Numerical Interpolation	Planned Hrs.	03
Lesson schedule					
Class No.	Details to be covered				
1	Least square curve fit and trigonometric approximations,				
2	Finite differences and difference operators				
3	Newtons interpolation formulae				

4	Gauss forward and backward formulae				
5	Sterling, Bessel's and Evertte's formulae				
Review Questions					
Q1	Solve numerical by finite differences and difference method.				**CO206.2**
Q2	Explain Gauss forward and backward formulae				
Q3	Explain Interpolation with unevenly space data.				
Section I					
Unit No	3	Unit Title	Numerical differentiation and integration	Planned Hrs.	04
Lesson schedule					
Class No.	Details to be covered				
1	Numerical differentiation, errors in numerical differentiation,				
2	Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules				
3	Romberg integration-recursive formulae				
4	Evaluation of double integrals by Trapezoidal and Simpson's rules				
Review Questions					
Q1	Solve numerical by Simpson's 1/3 and 3/8 rules.				**CO206.3**
Q2	Explain errors in numerical analysis.				
Section II					
Unit No	4	Unit Title	System of simultaneous algebraic equations	Planned Hrs.	04
Lesson schedule					
Class No.	Details to be covered				
1	Matrix inversion				
2	solution of transcendental and system of algebraic equations				
3	Gauss elimination method, Jacobi's method and Gauss-Seidal method				
4	Eigen values and Eigen vectors				
5	Jacobi's method				
Review Questions					
Q1	Perform matrix inversion.				**CO206.4**
Q2	Solution of transcendental and system of algebraic equations.				
Q3	Jacobi's method				
Section II					
Unit No	5	Unit Title	Ordinary differential equations	Planned Hrs.	04
Lesson schedule					

Class No.	Details to be covered	
1	Euler's method	
2	Modified Euler's method	
3	Runge Kutta methods of 2nd and 4th order	
4	Numericals on above methods	
Review Questions		
Q1	Solve by Euler's method	**CO206.5**
Q2	Solve by Euler's method Modified Euler's method	
Q3	Solve Runge Kutta methods of 2nd and 4th order	

Unit No	6	Unit Title	Applications to Civil Engg	Planned Hrs.	06

Lesson schedule		
Class No.	Details to be covered	
1	Major and minor losses	
2	Problems Formulation of various problems of Civil Engineering	
3	Calculation of slope & design of a beam	
4	Calculation of Seepage and development of flow nets	
5	Consolidation of soil layer	
6	Head loss due to friction	
Review Questions		
Q1	Write a program and use numerical method for Major and minor losses	**CO206.6**
Q2	Write a program and use numerical method Problems Formulation of various problems of Civil Engineering	
Q3	Write a program and use numerical method Calculation of Seepage and development of flow nets	

Assignments

No.	Question	Batches	CO
1	Problems on Solution of Nonlinear and Transcendental equations	ALL	CO206.1
	Roots of equations by Bisection method		
	Regula falsi method		
	Newton Raphson method		
	Secant method		

2.	Least square curve fit and trigonometric approximations,	ALL	
	Finite differences and difference operators		
	Newtons interpolation formulae		
	Gauss forward and backward formulae		
	Sterling, Bessel's and Evertte's formulae		
3	Numerical differentiation, errors in numerical differentiation,	ALL	CO206.3
	Numerical integration-Trapezoidal, Simpson's 1/3 and 3/8 rules		
	Romberg integration-recursive formulae		
	Evaluation of double integrals by Trapezoidal and Simpson's rules		
4	Matrix inversion	ALL	CO206.4
	solution of transcendental and system of algebraic equations		
	Gauss elimination method, Jacobi's method and Gauss-Seidal method		
	Eigen values and Eigen vectors		
	Jacobi's method		
5	Euler's method	ALL	CO206.5
	Modified Euler's method		
	Runge Kutta methods of 2nd and 4th order		
	Numericals on above methods		
6	Major and minor losses		
	Problems Formulation of various problems of Civil Engineering	ALL	CO206.6
	Calculation of slope & design of a beam		
	Calculation of Seepage and development of flow nets		
	Consolidation of soil layer		
	Head loss due to friction		