

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous) Dundigal, Hyderabad -500 043

FRESHMAN ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	Computational Mathematics and Integral Calculus
Course Code	:	AHS003
Class	:	I B. Tech I Semester
Branch	:	Common to CSE /ECE / EEE / IT
Year	:	2016 - 2017
Course Coordinator	:	Ms. V Subba Laxmi, Assistant Professor
Course Faculty	:	Ch. Kumara Swamy, Ms. L Indira,
		Mr. Ch Somashekar, Mr. G Nagendra Kumar

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	QUESTION	Blooms	Course
		taxonomy	Outcomes
		level	
	UNIT - I		
	ROOT FINDING TECHNIQUES AND INTERPOLAT	ION	
Part - A	A (Short Answer Questions)		
1	Define Interpolation	Remember	2
2	Explain forward difference interpolation	Understand	2
3	Explain backward difference interpolation	Understand	2
4	Explain central difference interpolation	Understand	2
5	Define average operator and shift operator	Remember	2
6	Prove that $\Delta = E - 1$	Analyze	2
7	Prove that $\nabla = 1 - E^{-1}$	Analyze	2
8	Prove that $(1+\Delta)(1-\nabla) = 1$	Analyze	2
9	Construct a forward difference table for $f(x)=x^3+5x-7$ if	Analyze	2
	x=-1,0,1,2,3,4,5	7 Hindi y Ze	
10	For what values of y the Gauss backward interpolation formula is used to	Understand	2
	interpolate?	Onderstand	
11	For what values of y the Gauss forward interpolation formula is used to	Understand	2
	interpolate?	Onderstand	
12	By using Regula - Falsi method, find an approximate root of the equation		1
	$x^4 - x - 10 = 0$ that lies between 1.8 and 2. Carry out two	Apply	
	approximations		

13	Evalua	te ∆	cos x	(Eva	luate	2
14	Find the	ne mi	ssing	term	in the f	ollowin	ig ta	ble						Ap	oply	2
	Х	0	1	2	3	4										
	У	1	3	9		81										
					-											
15	Apply	New	ton –	-Raph	son me	thod to	find	l an app	roxim	ate 1	root o	of the	9	A	pply	1
	equati	on x^2	° – 3.	x-5	=0, w	hich lie	s ne	ear x=2	carry o	out	two					
	approx	kimat	ions.													
16	Find a	real	root o	of the	equation	$n xe^{x} =$	2 u	ising m	ethod	of F	alse P	ositi	on.	Ap	oply	1
	Carry	out t	hree a	appro	ximatio	ns										
17	Find y	r(1.6)	fron	n the	followi	ng data	usi	ng Nev	vton's	forv	ward i	nter	polation	Ap	pply	1
	formu	la						_								
	x	1		1.4	1.8	2.2	2									
		2	10	1 00	5.04	6 6 5		1								
	У	3.4	19	4.82	5.90	0.0)									
18	Find a	real	root	of the	equation	on $x e^x$	- cc	$\mathbf{psx} = 0$	using	Ne	wton -	–Raj	phson	Ap	oply	1
10	metho	d car	ry ou	t thre	e appro	oximatio	ons.	.1	C (1					A	1	1
19	Find by $x a^{x}$	7 Nev	vton-	-Raph	son me	thod, th	e rea	al root (of the	equa	ation			Ap	pply	1
20	Leing	$\frac{3}{6} = 0$	o con	ck wa	rd diff	aronco	form	ula fin	$\frac{1}{d}$ v(2)	1) fi	rom th	a fo	llowing	Δr	nly	2
20	table	Gau	55 00	CK Wa	uu uni		IOIII	iuia iii	u y(2-	+) 11	ioni u		nowing	Л	pry	2
	v		0		5	10		15		20		25				
	X		0		5	10		13		20		23				
	У		7		11	14		18		24		32				
Part - H	B (Long	, Ans	wer	Quest	tions)											
1	Find t	he so	quare	root	of 25	up to	2 d	lecimal	place	s by	y usin	ıg B	sisection	Ap	ply	1
	metho	d.														
2	Find a	real	l root	t of th	he equa	ation e [*]	sin	x = 1	by us	sing	meth	od o	of False	Ap	ply	1
2	positio	$\frac{n}{2r}$	0001	- 2 h	v Nowt	on Don	haar	matha	d					Evol	nata	1
<u> </u>	Find	<u>2</u> X –	1 1 200	± 50	the equ	ntion 1		r = cor	u.	ina	math	od c	of Folco		uate nlv	1
-	Filla a	i iea	1 100	01 01	ule equ	Iation I	Ug J	$\lambda = 0.05$	s <i>x</i> us	mg	metho	ou c	JI Faise	11	'P ¹ y	1
5	Find a	m.	root	of 3v	cosr	1-0 usi	na N	Jourton	Panho	on	metho	d		Δn	nly	1
5	Fyalua	ite v	tanx+	$\frac{1-0}{1-0}$	v New	ton Ra	ng r nhse	on meth	napits		metho	u		Eva Eva	ipry luate	1
7	Find	the	$\frac{u n x}{v(2.8)}$	$\frac{1-0}{3}$ fo	r the	follow	ing	data	using	N	ewton	ı's	forward	An	nlv	1
	interpo	olatio	on for	mula.			8					-		r	F-J	-
	v	2	1	32	4.0	18		5.6	1							
	$f(\mathbf{x})$	2	. - 2	17.8	$\frac{4.0}{14.2}$	38.3	_	51.7	-							
	I(A)		2	17.0	14.2	50.5		51.7]							
8	Use N	ewto	n's fe	orwar	d diffei	rence for e_{α}	ormu	ila to fi	nd the	e po	lynom	nal s	satisfied	ap	ply	1
0	$\frac{\text{Dy }(0,.)}{\text{Find fit}}$	$\frac{(1)}{(42)}$,12),(from	<u>(2,37)</u> the fo	$\frac{100}{100}$	00). 1 data 11	sino	Newto	n's R	ach	vard fo	ormi	112	۸n	nly	2
		(+4)			,110 W III		sing		,	aurv	nuiu I	Jint		П	P17	-
	X	20	25	Í Í	30	35 4	-0	45								
	y 3	54	332	2 2	291 2	260 2	31	204								
10	The po	opula	tion o	of a to	own in	the deci	mal	census	was g	give	n belo	w. E	Estimate	Ap	ply	2
	the po	pulat	ion fo	or the	year 18	95			-							
		7		<u> </u>		1001	-	1011	105	1	40.5	1				
		(ear ((x)	1	891	1901	\perp	1911	192	1	193	1				
	Pop	ulatio	on (y))	46	66		81	93		101					
11	Find v	(25)	given	that	v(20)=2	24. v(24))=3	2. v(28)=35	v(32	2)=40	usin	g Gauss	An	nlv	2
	forwar	d dif	feren	ce for	mula.	, , (2-	.,	-, , (20	,,	, (52	-, 10	<i></i>	0 0 0 0 0 0 0 0		r-J	-
12	Find b	y Ga	uss's	back	ward in	terpola	ting	formul	a the v	valu	e of y	at x	= 1936	Ap	ply	2
	using the following table							-								

	X 1901 1911	1921 19	31	1941	1951			
	Y 12 15	20 27	,	39	52			
13	Find by Gauss's backw	vard interp	olating	formula	the value of y at $x =$	14	Apply	2
	using the following table	e						
	X 0 5 10	15	20	25	7			
	Y 7 11 14	18	24	32	-			
14	Find f (1 6) using Lagran	ngo'a form	aula fro	m tha fal	_ lowing table		Apply	2
14	rinu I (1.0) using Lagran	$\frac{11}{20}$	1u1a 110		iowilig table.		Аррту	Z
	$\begin{array}{c c} \Lambda & 1.2 \\ \hline f(u) & 1.26 \end{array}$	2.0	2.3		20			
	I(X) 1.50	0.38	0.54	+ 0	.20			
15	Find y(5) given that	y(0)=1,	y(1)=3,	y(3)=13	3 and y(8) =123 usi	ng	Apply	2
	Lagrange's formula.							
16	Find y(10), given that	at $y(5)=1$	2, y(6)=13, y	(9)=14, $y(11)=16$ usi	ng	Apply	2
17	Lagrange's formula.	the mainte	(0.19)	(1.10) (2 19 and (6.00) Eind t	ha	Apply	2
17	A curve passes through slope of the curve at x –	$\frac{1}{2}$	(0, 18)	,(1,10), (.	5,-18) and (0,90) Find t	ne	Арргу	2
18	Find the real root of the	equation y	$x^{3}-x-4=0$) by Bise	ction method		Apply	1
10	Find the real root of the	equation 2	$3x = e^{x}$	by Bisect	ion method.		Apply	1
20	Find the square root o	f 26 up 1	to 2 de	cimal pl	aces by using Newto	n-	Apply	1
	Raphson method	Ĩ		1	• •			
Part - C	C (Problem Solving and	Critical T	Thinkin	g Questi	ons)			-
1	Derive a formula to find	l a cube 1	oot of l	N using	Newton-Raphson meth	od	Understand	1
	and hence find cube roo	t of 15	D 1		1			1
2	Find reciprocal of 18 using $f(10)$ given by	$\frac{1}{1}$ ng Newt	on-Rapi	ison met	nod 7.15. man anti-malar and		Apply	1
3	Evaluate I(10) given	I(X) = 108, formula	192,330	at x=1	,7,15 respectively usi	ng	Evaluate	2
4	Prove that $\Delta[x(x+1)(x+2)]$	$\frac{10111101a}{2}(x+3)] = 4$	4(x+1)(x+1)(x+1)(x+1)(x+1)(x+1)(x+1)(x+1)	(x+2)(x+3))		Evaluate	2
5	Evaluate $\land \log f(x)$	2)(x+3)]=	T (X + 1)(2	<u>x+2)(x+</u> 2)		Evaluate	2
6	Evaluate $\Delta f(x)g(x)$						Evaluate	2
7	Find a root of the equ	ation r^3	-4r-	9 = 0.115	ing Risection method	in	Apply	1
	four stages		1.7) (u	ing Disection method			
8	Find a root of the eq	nuation x	$x^{3} - 5x$	+1 = 0	using the False Positi	on	Apply	1
	method in $5 - $ stages	quation of	2.11		using the Paise Posta			
9	Find a root of the equation	on $x^3 - 4$	4x - 9 =	= 0 using	Newton Raphson		Apply	1
	method in four stages				, i i i			
10	Compute $f(0.3)$ for the d	lata using	Lagran	ge's form	ula.		Apply	1
	x 0 1 3	4 7						
	y 1 3 49	129 8	13					
				UNIT	-II			
CUR	VE FITTING AND NUI	MERICA	L SOL	UTIONS	S OF ORDINARY DI	FFER	ENTIAL EQ	UATIONS
Part - A	A (Short Answer Question	ons)						2
2	Derive the normal equal	ions for s	raight h	aree par	abola		understand	3
3	Derive the normal equat	10113 101 30		egree par	hr		Remember	3
5	Write the normal equation	ons to fit t	he curv	$e y = ae^{2}$	•		itemenieer	5
4	Write the normal equation	ons to fit t	he curv	$e y = ab^x$			Remember	3
5	b.	· · ·	• , ,	1			Remember	3
	y = a + - 1s a curve thx	nen write	it s norr	nai equa	.10115.			
6	If $y = a_0 + a_1 x + a_2 x^2$	² then w ¹	nat is th	e third n	ormal equation of $\sum x^2$	v,	Remember	3
-	by least squares method	?				~ 1		-
7	If $y = a_0 + a_1 x^2$, then	what is the	e first no	ormal eq	ution of $\sum y_i$?		Remember	3

8	If $y = ax^b$, then what is the first normal equation of $\sum \log y_i$?							Remember	3			
9	Fit a cu	rve y	=ax	^b to the	e follo	wing c	lata				Understand	3
	X	-	1	2	3	4	5		6			
	у	4	2.98	4.26	5.21	6.1	0 6	.80	7.50			
10	Fit a sec squares.	cond d	legree	parabo	la to th	ne folle	owing	data	by the	method of least	Understand	3
	X	0		1	2		3	4				
	у	1		1.8	1.3	3	2.5	6	.3			
11	Fit the c	curve	y = a	e^{bx} to	the fol	lowing	g data				Understand	3
	Х	0	1	2	3	4	5	6	7	8		
	У	20	30	52	77	135	211	326	5 550	1052		
12	Fit a str	aight	line to	the for	m y=	=a+i	bx for	the f	ollowir	ig data	Understand	3
	X	0	5	10	15	2	0 2	25 20				
	У	12	15	17	22	24	4	50				
13	By the r	metho	d of le	ast squ	ares fi	t a par	abola	of the	form		Apply	3
	y = a	+bx-	$+cx^2$	for the	follov	wing d	ata					
	Х	2	4	(5	8	10					
	у	3.0	7 1	2.85	31.47	57.3	8 91	.29				
14	Asham	ical a	omnor	u wich	ing to	atudu	the off	Coat of	Paytroo	tion time on the	Understand	2
14	efficien	cy of	an ext	raction	operat	tion ob	otained	the d	lata sho	wn in the	Understand	3
	followii Extracti	ng tab on	le 27	45 4	1 1	9 3	3 39	19	49	15 31		
	time min(x)	in										
	Efficien (y)	су	57	64 8	0 4	6 (62 72	52	77	57 68		
	Fit a str	aight	line to	the giv	en dat	a by tl	he met	hod o	f least	squares		
15	Fit a pa	rabola	of the	e form	y = a	+bx	$+cx^{2}$	to the	e follov	ving data	Understand	3
	X	1	2	3		4	5	6	7			
	У	2.3	5.2	9.	7	16.5	29.4	4 3:	5.5 5	4.4		
16	Fit a sec squares	cond d	legree	parabo	la to th	ne folle	owing	data	by the	method of least	Understand	3
	X	0		1	2		3	4				
	У	1		1.8	1.3	}	2.5	6	.3			
17	Using 7	Faylor	's ser	ies met	hod fi	nd an	appro	xima	te valu	e of y at $x = 0$.1 Apply	4
	given y	(0)=1	for th	e diffei	ential	equati	on y	' = 32	$x + y^2$	-		
18	Using E	uler's	meth	od solv	e for	y' = y	$y^{2} + x$,y(0)=	=1 find	y(0.1) and y(0.2) Apply	4

19	Write the Modified Euler formula	Remember	4
20	Write the fourth order Runge- Kutta method	Remember	4
Part - E	B (Long Answer Questions)		-
1	By the method of least square, find the straight line that best fits the following data: x 1 3 5 7 9 y 1.5 2.8 4.0 4.7 6	Apply	3
2	By the method of least square, find the straight line that best fits the following data: x 1 2 3 4 5 y 14 27 40 55 68	Apply	3
3	Fit a straight line y=a +bx from the following data:	Understand	3
	x 0 1 2 3 4 y 1 1.8 3.3 4.5 6.3		
	Eit a straight line to the form $y = a \pm by$ for the following data:	Understand	3
-	x 0 5 10 15 20 25 y 12 15 17 22 24 30	Understand	5
5	By the method of least squares, fit a second degree polynomial $y=a+bx+cx^2$	Apply	3
	to the following data.		
	x 2 4 6 8 10		
	y 3.07 12.85 31.47 57.38 91.29		
6	Fit a curve $y=a+bx+cx^2$ from the following data	Understand	3
	X 1 2 3 4 X (11 18 27		
7	Y 0 11 18 27 Using the method of least squares find the constants a and h such that	Apply	3
/	$y=ae^{bx}$ fits the following data:	Аррту	5
	x 0 0.5 1 1.5 2 2.5		
	y 0.10 0.45 2.15 9.15 40.35 180.75		
8	Obtain a relation of the form $y=ab^x$ for the following data by the method of	Understand	3
	least squares.		
	x 2 3 4 5 6		
	y 8.3 15.4 33.1 65.2 127.4		
9	Using Taylor's series method find an approximate value of y at $x = 0.2$ for	Apply	4
	the differential equation $y' - 2y = 3e^x$, $y(0) = 0$		
10	Using Euler's method solve for $x = 2$ for $\frac{dy}{dx} = 3x^2 + 1$, $y(1) = 2$, taking	Apply	4
11	step size (i) $h = 0.5$ and (ii) $h=0.25$.	Englands	4
11	Solve by Euler's method, $y^2 = x + y$, $y(0) = 1$ and find $y(0.3)$ taking step size $h = 0.1$. compare the result obtained by this method with the result obtained by analytical methods	Evaluate	4
12	Using Runge-Kutta method of fourth order, find $v(0.2)$ where $v' = v - x$.	Apply	4
	y(0)=2, $h=0.2$		
13	Apply the 4 th order R-K method to find an approximate value of y when	Apply	4

	x=1.2 in steps of 0.1, given that $y' = x^2 + y^2$, y(1)=1.5			
14	Fit a curve $y=a+bx+cx^2$	Understand	d 3	
	x 1 2 3 4			
	y 6 11 18 27			
15	Obtain a relation of the form $v=ab^x$ for the following data:	Understand	d 3	
	x 2 3 4 5 6			
	y 8.3 15.4 33.1 65.2 127.4			
16	Solve $y^1 = x^2 - y$, $y(0) = 1$, using Taylor's series method and compute	Evaluate	4	
	y(0.1), $y(0.2)$, $y(0.3)$ and $y(0.4)$ (correct to 4 decimal places).			-
17	Using Euler's method solve for $y = 2$ from $\frac{dy}{dy} = 3x^2 + 1y(1) = 2$ taking	Apply	4	
	Using Euler's method solve for $x = 2$ from $\frac{dx}{dx} = -3x + 1$, $y(1) = 2$, taking			
	step size $h = 0.5$			
18	Using modified Euler's method find the approximate value of x when	Apply	4	
	x = 0.3 given that $dy/dx = x + y$ and $y(0) = 1$			
19	dv.	Apply	4	-
	Using Runge-Kutta method of second order, find $y(2.5)$ from $\frac{dy}{dt} =$	rr-J		
	dx			
	$\frac{x+y}{x+y}$, y(2)=2, h = 0.25.			
	x			_
20	Apply the 4 th order Runge-Kutta method to find an approximate value of y	Apply	4	
Dout (when $x=1.2$ in steps of 0.1,given that $y^2 = x^2+y^2$, $y(1)=1.5$			-
rart – (Using Runge-Kutta method find $v(0,2)$ for the equation	Apply	4	
1	dy/dx = y-x,y(0)=1, take h=0.2	Арргу	-	
2	Given that y^1 =y-x, $y(0)=2$ find $y(0.2)$ using R- K method take h=0.1	Apply	4	-
3	Apply the 4 th order R-K method to find an approximate value of y when x	Apply	4	-
	= 1.2 in steps of h= 0.1 given that $y' = x^2 + y^2$, y(1)=1.5			-
4	Solve first order difference $dy = y - x$	Evaluate	4	
	Solve first order diff equation $\frac{dx}{dx} = \frac{dx}{y+x}$, $y(0) = 1$ and estimate $y(0,1)$			
	using Euler's method(5 steps)			
5	Using modified Euler's method to find $y(0.2)$ and $y(0.4)$ given	Apply	4	
	$y' = y + e^x$, $y(0) = 0$.			_
6	Given $\frac{dy}{dx} = -xy^2$, y(0) = 2. compute y(0.2) in steps of 0.1, using	Remember	4	
	modified Euler's method.			
7	If for the data	Apply	3	
	x 1 2 3			
	y 0 -1 4			
	y = ax + b is the line of best fit by least square method find a and b			
	$\int dr $	Apply	3	1
8	If $y = a_0 + a_1 x$ find the values of $a_0 \propto a_1$ from the following	· • PP13	5	
	y -1 5 12 20			
9	dy	Apply	4	4
	Find the solution of $\frac{u_y}{l} = x-y$, y(0)=1 at x = 0.1, 0.2, 0.3, 0.4 and 0.5	- - PP+J		
	dx			
10	using modified Euler's method. Find $y(0, 1)$ and $y(0, 2)$ using modified Euler's formula given that $dy/dy = x^2$	Apply	A	-
10	y, $y(0)=1$, thhi		

	UNIT-III MULTIDE EINTECDALS	<u> </u>							
Part - A	Part - A (Short Answer Questions)								
1	Evaluate $\int_{0}^{2} \int_{0}^{x} y dy dx$	Evaluate	5						
2	Evaluate $\int_0^{\pi} \int_0^{\alpha \sin \theta} d\theta$.	Evaluate	5						
3	Evaluate $\int_0^3 \int_0^1 xy(x + y) dx dy$.	Evaluate	5						
4	Evaluate $\int_{1}^{e} \int_{1}^{\log y} \int_{2}^{e^{x}} ogz dx dy dz$.	Evaluate	5						
5	Find the value of $\int_{-1}^{1}\int_{-2}^{2}\int_{-3}^{3}dxdydz$.	Apply	5						
6	Write the spherical polar coordinates	Remember	5						
7	Write the cylindrical polar coordinates	Remember	5						
8	Evaluate $\int_0^{\pi} \int_0^{a\sin\theta} r dr d\theta$	Evaluate	5						
9	Evaluate $\int_0^\infty \int_0^{\pi/2} e^{-r^2} r d\theta dr$	Evaluate	5						
10	Evaluate $\int_0^{\pi} \int_0^{a(1+\cos\theta)} r dr d\theta$	Remember	5						
11	Evaluate $\int_{0}^{\pi/4} \int_{0}^{a\sin\theta} \frac{rdrd\theta}{\sqrt{a^2 - r^2}}$	Evaluate	5						
12	Evaluate $\int_{0}^{1} \int_{0}^{\frac{\pi}{2}} r \sin \theta d\theta dr$	Evaluate	5						
13	Evaluate $\int_{0}^{\infty} \int_{0}^{\infty} e^{-(x^2+y^2)} dx dy$	Evaluate	5						
14	Evaluate $\int_{0}^{\frac{\pi}{2}} \int_{0}^{1} x^2 y^2 dx dy$	Evaluate	5						
15	Evaluate $\int_{0}^{2} \int_{0}^{x} e^{(x+y)} dy dx$	Evaluate	5						
16	Evaluate $\int_{0}^{1} \int_{x}^{\sqrt{x}} (x^{2} + y^{2}) dx dy$	Evaluate	5						
17	Evaluate $\int_{0}^{4} \int_{0}^{x^{2}} e^{y/x} dy dx$	Evaluate	5						
18	Evaluate $\int_{0}^{5} \int_{0}^{x^{2}} x(x^{2} + y^{2}) dx dy$	Evaluate	5						

19	Evaluate $\int_{1}^{2} \int_{1}^{x} y dy dx$	Evaluate	5
	J J ² ²		
20	Evaluate $\int_{1}^{2} \int_{0}^{3} x y^2 dx dy$	Evaluate	5
	1 1		
Part – I	B (Long Answer Questions)4		
1	By transforming into polar coordinates Evaluate $\iint \frac{x^2 y^2}{x^2 + y^2} dx dy$ over the	Evaluate	6
	annular region between the circles $x^2 + y^2 = a^2$ and $x^2 + y^2 = b^2$ with $b > a$		
2	Evaluate $\iiint_{R} (x + y + z) dz dy dx$ where R is the region bounded by the plane	Evaluate	6
	x = 0, x = 1, y = 0, y = 1, z = 0, z = 1		
3	$\int_{0}^{1} \int_{0}^{1-z} \int_{0}^{1-y-z} xyz dx dy dz$ Evaluate 0 0 0	Evaluate	6
4	Find the volume of the tetrahedron bounded by the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$	Apply	6
	and the coordinate planes by triple integration		
5	Evaluate $\int_{0}^{\pi} \int_{0}^{a(1+\cos\theta)} r^2 \cos\theta dr d\theta$	Evaluate	5
6	Find the value of $\iint xydxdy$ taken over the positive quadrant of the	Apply	6
	ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$		
7	Evaluate $\int_{0}^{\frac{\pi}{2}} \int_{0}^{a\sin\theta} \int_{0}^{\frac{a^2-r^2}{2}} rdz dr d\theta$	Evaluate	6
8	Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dy dx}{1+x^2+y^2}$	Evaluate	6
9	Evaluate $\int_{0}^{5} \int_{0}^{x^{2}} x(x^{2} + y^{2}) dx dy$	Evaluate	6
10	By changing the order of integration evaluate $\int_{0}^{1} \int_{x^{2}}^{2-x} xy dx dy$	Evaluate	6
11	Evaluate the double integral $\int_{0}^{a} \int_{0}^{\sqrt{a^{2}-y^{2}}} (x^{2}+y^{2}) dy dx$	Evaluate	6

12	$\int_{0}^{\log 2} \int_{0}^{x} \int_{0}^{x+\log y} e^{x+y+z} dx dy dz$	Evaluate	6
	Evaluate 0 0 0		
13	Evaluate by changing the order of integration $\int_{0}^{a} \int_{\sqrt{ax}}^{a} \frac{y^2}{\sqrt{y^4 - a^2x^2}} dy dx$	Evaluate	6
14	Evaluate $\int_{0}^{\pi/2} \int_{0}^{\infty} \frac{r^2}{(r^2 + a^2)^2} dr d\theta$	Evaluate	6
15	Evaluate $\iint x^2 dx dy$ over the region bounded by hyperbola $xy = 4, y = 0, x = 1, x = 4$	Evaluate	6
16	Find the value of double integral $\int_{1}^{2} \int_{1}^{3} xy^2 dx dy$	Apply	6
17	Evaluate $\iint r^3 dr d\theta$ over the area included between the circles $r = 2\sin\theta$ and $r = 4\sin\theta$	Evaluate	6
18	Change the order of integration in $\int_{0}^{1} \int_{x^2}^{2-x} xy dx dy$ and hence evaluate the	Evaluate	6
	double integral.		
19	Evaluate $\iiint_{v} dxdydz$ where v is the finite region of space formed by the	Evaluate	6
20	planes x=0,y=0,z=0 and $2x+3y+4z=12$ Find the area of the region bounded by the parabola $y^2 = 4ax$ and $x^2=4ay$	Apply	6
Part - C	C (Problem Solving and Critical Thinking Questions)		
1	An equivalent iterated integral with order of integration reversed for $\int_{0}^{1} \int_{1}^{e^{x}} dy dx$ is?	Analyse	6
2	How to find the area of bounded region.	Analyze	6
3	Convert $\int_0^a \int_1^{\sqrt{a^2 - x^2}} (x^2 + y^2) dy dx$ to polar co-ordinates	Remember	6
4	What is the area of $\iint r^3 dr d\theta$ over the region included between the circles $r = \sin\theta$, $r = 4\sin\theta$.	Remember	6
5	Find the volume of tetrahedron bounded by the co-ordinate planes and the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$	Apply	6
6	Find the area of the region bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$.	Apply	6
7	Find the area of a plate in the form of a quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	Apply	6
8	Find the area enclosed by the parabolas $x^2 = y$ and $y^2 = x$.	Apply	6
9	Using double integral find area of the cardioids $r = a(1-\cos\theta)$.	Apply	6

10	Find the whole area of the lemniscates $r^2 = a^2 cos 2\theta$	Apply	6				
	UNIT-IV						
VECTOR CALCULUS							
Part –	A (Short Answer Questions)						
1	Define gradient?	Remember	7				
2	Define divergence?	Remember	7				
3	Define curl?	Remember	7				
4	Define Laplacian operator?	Remember	7				
5	Find curl f where $f = \operatorname{grad}(x^3 + y^3 + z^3 - 3xyz)$	Apply	7				
6	Evaluate the angle between the normal to the surface $xy=z^2$ at the points (4,1,2) and (3,3,-3)?	Understand	7				
7	Find a unit normal vector to the given surface $x^2y+2xz=4$ at the point (2,-2,3)?	Apply	7				
8	If \bar{a} is a vector then prove that grad $(\bar{a}, \bar{r}) = \bar{a}$?	Understand	7				
9	Define irrotational and solenoidal vectors?	Remember	7				
10	Prove that $(\nabla f \times \nabla g)$ is solenoidal?	Analyze	7				
11	Prove that F=yzi+zxj+xyk is irrotational?	Analyze	7				
12	Show that $(x+3y)i+(y-2z)j+(x-2z)k$ is solenoidal?	Understand	7				
13	Show that $\operatorname{curl}(r^n \overline{r}) = 0$?	Understand	7				
14	Prove that $curl(\phi \bar{a}) = (grad\phi) \times \bar{a} + \phi curl \bar{a}$?	Analyze	7				
15	Prove that div curl $\bar{f}=0$?	Analyze	7				
16	Define line integral?	Remember	7				
17	Define surface integral?	Remember	7				
18	Define volume integral?	Remember	7				
19	State Green's theorem?	Understand	8				
20	State Gauss divergence theorem?	Understand	8				
Part - I	B (Long Answer Questions)						
1	Evaluate $\int_{C} \overline{f} \cdot d\overline{r}$ where $f = 3xyi - y^2j$ and C is the parabola $y=2x^2$ from	Understand	7				
	(0,0) to $(1,2)$.	XX 1 . 1					
2	Evaluate $\iint \overline{F}.d\overline{s}$ if $f = yzi + 2y^2j + xz^2k$ and S is the Surface of the	Understand	/				
	S Cylinder $x^2+y^2=9$ contained in the first Octant between the planes z=0 and z=2.						
3	Evaluate $\oint (yz dx + xz dy + xy dz)$ over arc of a helix	Understand	7				
	$x = a \cos t$, $y = a \sin t$, $z = kt$ as t varies from 0 to 2π .						
4	Find the circulation of \overline{f} around the curve c Where	Apply	7				
	$\overline{f} = (e^x \sin y)i + (e^x \cos y)j$ and c is the rectangle whose vertices are						
	$(0,0),(1,0),(1,\frac{\pi}{2}),(0,\frac{\pi}{2})$						
5	Verify Gauss divergence theorem for the vector point function $F=(x^3-yz)i-2yxi+2zk$ over the cube bounded by $x=y=z=0$ and $x=y=z=a$	Apply	8				
6	Verify Gauss divergence theorem for $2x^2yi - y^2j + 4xz^2k$ taken over the	Apply	8				
	region of first octant of the cylinder $y^2 + z^2 = 9$ and $x = 2$						
7	Verify Green's theorem in the plane for $\int (x^2 - xy^3) dx + (y^2 - 2xy) dy$	Apply	8				
	where C is a square with vertices $(0,0),(2,0),(2,2),(0,2)$.						
8	Applying Green's theorem evaluate $\int (y - \sin x) dx + \cos x dy$ where C is the	Apply	8				
	plane Δ^{le} enclosed by $y = 0$, $y = \frac{2x}{\pi}$, and $x = \frac{\pi}{2}$						

9	Verify Green's Theorem in the plane for $\int (x^2 - xy^3) dx + (y^2 - 2xy) dy$	Apply	8
	where C is a square with vertices $(0,0)$ $(2,0)$ $(2,2)$		
10	Verify Stokes theorem for $f = (2x - y)i - yz^2 i - y^2zk$ where S is the	Apply	8
10	upper half surface $x^2+y^2+z^2=1$ of the sphere and C is its boundary		Ũ
11	Verify Stokes theorem for $f = (x^2 - y^2)i + 2xyi$ over the box bounded by		
	the planes $x=0.x=a.y=0.y=b.z=c$	Apply	
	1 7 75 75 7		8
12	Verify Stokes theorem for $f = (x^2 - y^2)i + 2yi$, over the box bounded by	Apply	8
	the planes $x=0, x=a, y=0, y=b, z=c$	II J	_
13	Evaluate by Stroke's Theorem $\iint_{s} Curl \vec{F}.\vec{n}ds \text{where}$	Understand	8
	$\vec{F} = y^2 \vec{i} + x^2 \vec{j} - (x+Z)/\overline{C}$ and S comprising the planes x=0,y=0,y=4; z =-1		
14	If $\overline{f} = (5xy - 6x^2)\overline{i} + (2y - 4x)\overline{j}$ evaluate $\int_{C} \overline{f} \cdot d\overline{r}$ along the curve C in	Understand	8
	xy-plane $y = x^3$ from (1,1) to (2,8).		
15	Evaluate $\iint \overline{F}.d\overline{s}$ if $f = yzi + 2y^2j + xz^2k$ and S is the Surface of the	Understand	7
	Cylinder $x^2+y^2=9$ contained in the first Octant between the planes z=0 and z=2.		
16	Evaluate $\oint_{c} (yz dx + xz dy + xy dz)$ over arc of a helix	Understand	7
	$x = a \cos t$, $y = a \sin t$, $z = kt$ as t varies from 0 to 2π .		
17	Evaluate by Stokes theorem $\int (e^x dx + 2y dy - dz)$ where c is the curve	Understand	8
	$x^2+y^2=9$ and $z=2$		
18	Verify Stokes theorem for $x^2 i + xy j$ integrated round the square in the	Apply	8
	plane z=0 whose sides are along the line x=0,y=0,x=a,y=a		
19	Verify divergence theorem for $\overline{f} = x^3 \overline{i} + y^3 \overline{j} + z^3 \overline{k}$ taken over the cube	Apply	8
	bounded by x=0,x=a,y=0,y=a,z=0,z=a		
20	Verify Green's theorem in the plane for	Apply	8
	$\int (3x^2 - 8y^2) dx + (4y - 6xy) dy$ where C is a region bounded by y=		
	c		
	\sqrt{x} and y = x ²		
Part –	C (Problem Solving and Critical Thinking)		
	Verify Gauss divergence theorem for $\overline{f} = x^2 \overline{i} + y^2 \overline{j} + z^2 \overline{k}$ taken over	Understand	8
1	the cube bounded by x=0,x=a,y=0,y=b,z=0,z=c.		
2	Evaluate $\iint_{s} \overline{F}.d\overline{s}$ if $f = yzi + 2y^2j + xz^2k$ and S is the Surface of the	Understand	7
	Cylinder $x^2+y^2=9$ contained in the first Octant between the planes z=0 and z=2.		
3	Evaluate $\oint_{c} (yz dx + xz dy + xy dz)$ over arc of a helix	Understand	7
	$x = a \cos t$, $y = a \sin t$, $z = kt$ as t varies from 0 to 2π .		
4	Find the circulation of \overline{f} around the curve c Where	Apply	8
	$\bar{f} = (e^x \sin y)i + (e^x \cos y)j$ and c is the rectangle whose vertices are		

	$(0,0),(1,0),(1,\frac{\pi}{2}),(0,\frac{\pi}{2})$		
5	Use Gauss divergence theorem to evaluate $\iint_{s} \overline{F}.d\overline{s}$ where	Apply	8
	$\bar{f} = x^3 i + y^3 j + z^3 k$ and $x^2 is the surface of the subset$		
	$x^2 + y^2 + z^2 = r^2$		
6	Verify divergence theorem for $2x^2yi - y^2j + 4xz^2k$ taken over the region of	Apply	8
	first octant of the cylinder $y^2 + z^2 = 9$ and $x = 2$		
7	Verify Green's theorem in the plane for $\int (x^2 - xy^3) dx + (y^2 - 2xy) dy$	Apply	8
	where C is a square with vertices (0.0) , (2.0) , (2.2) , (0.2) .		
8	Applying Green's theorem evaluate $\int (y - \sin x) dx + \cos x dy$ where C is the	Apply	8
	plane Δ^{le} enclosed by $y = 0$, $y = \frac{2x}{\pi}$, and $x = \frac{\pi}{2}$		
9	Verify Green's Theorem in the plane for $\int (x^2 - xy^3) dx + (y^2 - 2xy) dy$	Apply	8
	$- \int_{c} (x - xy) dx + (y - 2xy) dy$	- * *	
10	where C is a square with vertices (0,0),(2,0),)(2,2),(0,2)	A 1	0
10	Verify Stokes theorem for $f = (2x - y)i - yz^2j - y^2zk$ where S is the	Apply	8
	upper half surface $x^++y^++z^+=1$ of the sphere and C is its boundary UNIT-V		
	SPECIAL FUNCTIONS		
Part - A	(Short Answer Questions)		1
1	Show that $\Gamma(1/2) = \sqrt{\pi}$	Evaluate	9
2	Write the value of $\gamma(1)$.	Remember	9
3	Compute $\gamma(11/2), \gamma(1/2), \gamma(-7/2)$.	Apply	9
4	Define ordinary point of differential equation	Remember	9
5	Define regular singular point of differential equation	Remember	9
6	solve in series the equation $y'' + x y' + y = 0$ about $x = 0$	Evaluate	9
7	Solve in series the equation $\frac{d^2y}{dx^2} - y = 0$ about x=0	Evaluate	9
8	Solve in series the equation $y'' + y = 0$ about x=0	Evaluate	9
9	Solve in series the equation $\frac{d^2y}{dx^2} + xy = 0$	Evaluate	9
10	Solve in series the equation $\mathbf{y}'' + \mathbf{x}^2 \mathbf{y} = 0$ about x=0	Evaluate	9
11	Prove that $xJ'_n(x) = n J_n(x) - x J_{n+1}(x)$		10
12	Prove that $xJ'_n(x) = -n J_n(x) + x J_{n-1}(x)$	Analyse	10
13	Prove that $J'_n(x) = \frac{1}{2}[J_{n-1}(x) - J_{n+1}(x)]$	Analyse	10
14	Prove that $J'_n(x) = \frac{1}{2}[J_{n-1}(x) - J_{n+1}(x)]$	Analyse	10
15	Express $J_2(x)$ in terms of $J_0(x)$ and $J_1(x)$	Apply	10
16	Prove that $J_0^2 + 2(J_1^2 + J_2^2 + J_3^2 + \dots) = 1$	Analyse	10
17	Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$	Analyse	10
18	Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cos x$	Analyse	10
19	Prove that $J_{\frac{3}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{1}{x} \sin x - \cos x\right)$	Analyse	10

20	$\overline{2(3-r^2)}$	Analyse	10		
	Prove that $J_{5/x}(x) = \sqrt{\frac{2}{x}} \frac{3-x}{2} \sin x - \frac{3}{2} \cos x$				
	$72 \sqrt{\pi x} \left(x^2 - x \right)$				
Part - B (Long Answer Questions)8					
1	Show that (i) $\int_{0}^{x} x^{n} J_{n-1}(x) dx = x^{n} J_{n}(x)$	Analyse	10		
2	Show that $\int_{0}^{x} x^{n+1} J_{n}(x) dx = x^{n+1} J_{n+1}(x)$	Analyse	10		
3	Prove that $\frac{d}{dx}[J_n^2 + J_{n+1}^2] = \frac{2}{x}[nJ_n^2 - (n+1)J_{n+1}^2]$	Analyse	10		
4	Show that $\frac{d}{dx}[x^n J_n(ax)] = ax^n J_{n-1}(ax)$	Remember	10		
5	Show that $J_n(x) = \frac{1}{\pi} \int_0^{\pi} \cos(n\theta - x\sin\theta) d\theta$	Remember	10		
6	Show that $J_n(x) = \frac{1}{\pi} \int_0^{\pi} \cos(n\theta - x\sin\theta) d\theta$	Remember	10		
7	Prove that $\int J_3(x) dx = -J_2(x) - \frac{2}{x} J_1(x)$	Evaluate	10		
8	State and prove orthogonality of Bessel's function	Analyse	10		
9		Evaluate	10		
	Show that				
	$\cos(x\sin\theta) = J_0 + 2(J_2\cos 2\theta + J_4\cos 4\theta + \dots)$				
10	Show that $\sin(x\sin\theta) = 2(J_1\sin\theta + J_3\sin3\theta + J_5\sin5\theta)$	Evaluate	10		
11	Solve in series the equation $\frac{d^2y}{dx^2} - y = 0$ about x=0	Evaluate	9		
12	Solve in series the equation $v'' + (3 - x)v' + v = 0$ in powers of	Evaluate	9		
	(x-2).				
13	Solve in series the equation $\frac{d^2y}{dx^2} + xy = 0$	Evaluate	9		
14	Solve in series the equation $y'' + x^2 y = 0$ about x=0	Evaluate	9		
15	Solve in series the equation $2x^2 y'' + (x^2 - x) y' + y = 0$	Evaluate	9		
16	Solve in series the equation $x(1-x)y'' - (1+3x)y' - y = 0$	Evaluate	9		
17	Solve in series the equation $(x - x^2)y'' + (1 - 5x)y' - 4y = 0$	Evaluate	9		
18	Solve in series the equation $2x^2 y'' + x y' - (x + 1)y = 0$	Evaluate	9		
19	Solve in series the equation $x(1-x)y'' - 3x y' - y = 0$	Evaluate	9		
20	Solve in series the equation $\frac{d^2y}{dx^2} - y = 0$ about x=0	Evaluate	9		
Part –	C (Problem Solving and Critical Thinking)				
1	Explain Frobenius method about zero.	Remember	9		
2	Find the singular points and classify them (regular or irregular) $x^{2} y'' + a x y' + b y = 0$	Analyse	9		
	Find the singular points and classify them (regular or irregular)	Analyse	9		
3	$x^{2} y'' - 5y' + 3x^{2}y = 0$ Find the singular points and cloself, then (as because 1) 2^{2} "	A mol	0		
4	Find the singular points and classify them (regular or irregular) $x^2 y^2 - 5y' + 3x^2y = 0$	Analyse	9		
5	Solve in series the equation $4x \frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0.$	Evaluate	9		
6	Solve in series $xy'' + y' + xy = 0$.	Evaluate	9		
7	Solve in series $x(1-x)y'' - 3x y' - y = 0$.	Evaluate	9		
8	Solve in series $y'' + x^2 y = 0$.	Evaluate	9		
9	Solve in series the equation $(x - x^2)y'' + (1 - 5x)y' - 4y = 0$	Evaluate	9		
10		Analyse	10		
	Prove that $\begin{vmatrix} J_{\frac{1}{2}} \end{vmatrix} + \begin{vmatrix} J_{-\frac{1}{2}} \end{vmatrix} = \frac{2}{\pi x}$				

Prepared By: Ch. Kumara Swamy V Subbalaxmi L Indira Ch Somashekar G Nagendra Kumar

HOD, FRESHMAN ENGINEERING