	INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80	
Fr	amination Control Division	Programme	All (Except BAR)	Pass Marks	32	
LA	2079 Baishakh	Year / Part	I- /PI	Time	3 hrs.	
	Subject: - Engineer	ring Mathemat	ics I (SH 401)			
* * * *	Candidates are required to give their ans Attempt <u>All</u> questions. The figures in the margin indicate <u>Full</u> Assume suitable data if necessary.	swers in their ov Marks	vn words as far as	practicable.		
1.	State Leibnitz's theorem. If $y = log(x (a^2 + x^2)y_2 + xy_1 = 0)$ and hence show that (a	$+\sqrt{a^2 + x^2}$) t $x^2 + x^2$)y _{n+2} + (2n	hen using the the $(1)xy_{n+1} + n^2y_n = 0.$	orem show	that [1+4]
2.	Assuming the validity of expansion, find theorem.	I the expansion	of: log(secx) by u	sing Maclaur	in's	[5]
3.	What do you mean by indeterminate for $\frac{1}{1}$	rm? State variou	is forms of indeter	minacy. Evalu	late	
	$ \lim_{x \to 0} \left(\frac{\sin x}{x} \right) x^2 . $					[5]
4.	Define asymptotes and its types. Find the as	symptotes of the	curve			
	$x^{3} + 4x^{2}y + 5xy^{2} + 2y^{3} + 2x^{2} + 4xy + 2y^{2} - x$	-9y + 1 = 0.			l	1+4]
5.	Find the pedal equation of the curve of $r^{m} =$	a'''cosmθ.				[2]
6.	Show that $\int_{0}^{\pi/2} \frac{x}{\sin x + \cos x} dx = \frac{\pi}{2\sqrt{2}} \log \frac{\pi}{2\sqrt{2}}$	$g(\sqrt{2}+1)$.				[5]
* 7.	Evaluate, by using the rule of differentiatio	n under the sign o	of integration: $\int_0^{\pi} \frac{\mathrm{lo}}{\mathrm{d}t}$	$\frac{g(1 + a \cos x)}{\cos x}$	dx.	[5]
8.	Define Beta and Gamma function and use t	hese to evaluate	$\int_0^1 \frac{dx}{(1-x^6)^{\frac{1}{6}}} .$			[5]
9.	Find the area included between an arc of cy	$\sqrt{\text{cloid } \mathbf{x} = \mathbf{a}(\mathbf{\theta} - \mathbf{s})}$	$n \theta$), $y = a(1 - \cos\theta)$	and its base.		
	Find the volume of the solid formed by re base.	volution of the c	ardoid $r = a(1 + \cos \theta)$) about the in	itial	[5]
10.	Solve the differential equation $\frac{dy}{dx} + \frac{x}{1-x^2}$	$\frac{1}{2}y = x\sqrt{y}$.				[5]
11.	State Clairatut's equation, find the general	and singular solu	tion of $y = px + p - p$	p ² . ential equa	tion	[5]
12.	$y'' - 2y' + 5y = e^{2x} \sin x.$					[5]
13.	Solve the differential equation $x^2 \frac{d^2y}{dx^2}$	$x\frac{dy}{dx} + 2y = x lc$	og x .			[5]
14.	Through what angle should the $3x^2 + 2xy + 3y^2 - \sqrt{2}x = 0$ into one we equation.	axes be ro	stated to reduce nissing? Also obtai	the equant the transfor	ition med [[2+3]
15.	Deduce the standard equation of the hyper	bola.				· [5]
16.	Describe and sketch the graph of the equat	tion $r = \frac{10}{2 - 3\sin^2 \theta}$	θ			
		OR				
	Find the centre, length of $3x^2 + 8xy - 3y^2 - 40x - 20y + 50 = 0$.	axes and	eccentricity o	f the c	onic	[5]

Back TRIBHUVAN UNIVERSITY Exam. 80 Full Marks BE Level INSTITUTE OF ENGINEERING All except BAR Pass Marks 32 **Examination Control Division** Programme 3 hrs. Time Year / Part 1/1 2078 Kartik Subject: - Engineering Mathematics I (SH 401) ✓ Candidates are required to give their answers in their own words as far as practicable. ✓ Attempt <u>All</u> questions. All question carry Equal Marks. ✓ Assume suitable data if necessary. 1. State Leibnitz's theorem. If $y^{1/m} + y^{-1/m} = 2x$, prove that $(x^2 - 1)y_2 + xy_1 - m^2 y = 0$, and hence show that $(x^2 - 1)y_{n+2} + (2n+1)xy_{n+1} + (n^2 - m^2)y_n = 0$. 2. Apply Maclaurin's series to find the expansion of $\frac{e^x}{1+e^x}$ as far as the term in x^3 and hence find the expansion of $log(1+e^x)$. • 3. State L-Hospital's rule. Evaluate $\lim_{x \to 0} \left(\frac{\sin x}{x}\right)^{1/x^2}$ 4. Find the asymptotes of the curve of $x^2(x-y)^2 - a^2(x^2 + y^2) = 0$. 5. Define the radius of curvature, obtain the radius of curvature for the curve at the origin $x^3+y^3=3axy.$ 6. Prove that: $\int_{0}^{\pi} \frac{x \tan x}{\sec x + \tan x} dx = \frac{\pi}{2} (\pi - 2)$ 7. Apply the method of differentiation under integral sign to prove. $\int_{0}^{\pi} \frac{dx}{(a+b\cos x)^2} = -\frac{\pi a}{(a^2 - b^2)^{3/2}}$ 8. State Beta and Gamma function. Use them to evaluate: $\int x^6 \sqrt{1-x^2} dx$ 9. Define the term quadrature. Find the area bounded by the curve $r = a(1 - \cos \theta)$. OR Find the volume of the solid formed by the revolution of cycloid $x = a(\theta + \sin \theta)$, $y = a(1 + \cos \theta)$ about x-axis. 10. Solve the differential equations: (x+y+1)dx + (y-x)dy = 011. Find the general solution of the differential equation: $e^y - p^3 - p = 0$ where $p = \frac{dy}{dx}$.

- 12. Solve the different equation: $(D^2 + 2D + 1)y = e^x + x^2$
- 13. Solve: $(x^2D^2 + xD 1)y = x^2$

OR

A radioactive material has an initial mass 100mg. After 2 years, it is left to 80mg. Find the amount of material at any time t.

- 14. Through what angle the axes be rotated to remove the term containing xy in $11x^2 + 4xy + 14y^2 5 = 0$.
- 15. Define hyperbola as a locus of a point and deduce the equation of hyperbola in standard form.

 $3x^2 + 8xy - 3y^2 - 20y - 40x + 50 = 0$

16. Find the center, length of axes, and eccentricity of the following conic:

INSTITUTE OF ENGINEEPING	Lough	DE	Regular	20
Evamination Control Division	Deve	BE	Full Marks	80
2078 Bhadra	Programme	All except BAR	Pass Marks	32
	Tear / Fart	[1/1	lime	<u> </u>
Subject: - Engine	ering Mathema	tics I (SH 401)		
 ✓ Candidates are required to give their a ✓ Attempt <u>All</u> questions. ✓ The figures in the margin indicate <u>Fu</u> 	answers in their o	wn words as far	as practicable	
✓ Assume suitable data if necessary.				
1. If $y=(x^2-1)^n$, then prove that: $(x^2-1)y$	$y_{n+2} + 2xy_{n+1} - n$	$(n+1)y_n = 0$	1999 1997 1998 1999 1999 1999 1999 1999	[5]
2. Assuming the validity of expansion, e	xpand log(1+x) b	y using Maclaur 1	in's theorem.	[5]
3. Give an example of indeterminate from	m. Evaluate: $\lim_{x \to x} x \to x$	$\log(\cot x)^{\log x}$		[5]
4. Find the asymptote of the curve: $(x^2 -$	$(-y^2)^2 - 2(x^2 + y^2)$	$(x^2) + x - 1 = 0$		[5]
5. Find the radius of curvature for the cu	rve $r^m = a^m \cos n$	nθ.		[5]
	OR			
Find the pedal equation of the followin	ng curves $y^2 = 4c$	a(x+a).		[5]
6. Evaluate: $\int_{0}^{1} \frac{\log(1+x)}{(1+x^2)} dx$				[5]
7. Evaluate by using the rule of	differentiation u	inder the sign	of integro	tion
$\int_{1}^{\infty} lbg(1+q^2x^2)$		inder the sign	or integra	
$\int_{0}^{\frac{-\delta(1-x-x)}{1+b^2x^2}} dx$				[5]
8. Define Gamma function. Use it to prov	$\pi/8 = \int_{0}^{\pi/8} \cos^3 4x dx =$	$=\frac{1}{6}$		[5]
9. Find the area of a loop of the curve : a	$^{2}y^{2} = a^{2}x^{2} - x^{4}$ OR			[5]
Prove that the volume and surface a	rea of a sphere	of radius 'a' is	$\frac{4}{-\pi a^3}$ and 4	πa ²
respectively.			3	[5]
to out dy year year 2				[2]
10. Solve: $\frac{y}{dx} + \frac{y}{x} \log y = \frac{y}{x^2} (\log y)^2$				[5]
11. Find the general solution of the different 12. Solve: $(D^2+3D+2)y = e^{2x} sinx$	ntial equation y =	$(1+p)x + ap^2$.		[5]
13. Solve: $(x^2D^2 - 2)y = x^2 + \frac{1}{2}$				[-]
X	OR			
A certain culture of bacteria grows at r days, find the time required for the culture	ate proportional to ure to increase to	o its size. If the 10 times to its o	size doubles i	in 4 [5]
14. Through what angle must the axes b	be rotated to ren	nove the term	containing xy	in in
$11x^{-} + 4xy + 14y^{-} = 5.$				[5] ,
15. Prove that: $2x^2 + 3y^2 - 4x - 12y + 13 =$ length of axes, eccentricity, and direct ic	= 0 represents equ ces of ellipse.	ation of ellipse.	Find its cen	ter, [5]
16. Show that the line $x\cos\alpha + y\sin\alpha = p$	will be a tangent	to the hyperbol	$\frac{x^2}{x^2} - \frac{y^2}{x^2} = 1$	if
			a b	

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	TRIBHUVAN UNIVERSITY	Exam.	DE	Regular .	m	
	INSTITUTE OF ENGINEERING	Level	BE All avecant DAP	Full Marks	38	
	Examination Control Division	Vear / Part	1/1	Time	3 hrs.	
	2070 Chaltra				<u></u>	
	Subject: - Engineer	ing mathema	tics I (SH 401)		tan ana ina ina ina ina ina ina ina ina i	
	 ✓ Candidates are required to give their ans ✓ Attempt <u>All</u> questions. ✓ <u>All</u> questions carry equal marks. ✓ Assume suitable data if necessary. 	swers in their o	wn words as far	as practicable		
	1. If y=acos(log x) + b sin(log x) prove that	t:				
	(i) $x^2y_2+xy_1+y=0$ (ii) $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$					¥.
	2. State and prove Lagrange's mean value t	theorem.				
	3. State L' Hospital's Rule and hence evalu	ate $\lim_{x \to 0} (\cot x)$	x) ^{sin 2x}			
	4. Find the asymptote of $(x+y)^2(x+2y+2) =$	x+9y-2				
	5. Find the radius of curvature of the curve	$r = a (1 - \cos\theta)$).			
	Find the pedal equation of $y^2=4a(x+a)$	OI,				
	6. Evaluate $\int_{0}^{\pi/2} \frac{x \sin x \cos x}{\cos^4 x + \sin^4 x} dx$					
	7. Using the rule of differentiation under th	e integral sign,	evaluate $\int_{0}^{\infty} \frac{\log(1-1)}{1-1}$	$\frac{1+a^2x^2)}{b^2x^2} dx$		
	8. Obtain the reduction formula for $\int_{0}^{\pi/2} \cos^{n}$	xdx and hence	evaluate $\int_{0}^{\pi/2} \cos \theta$	¹⁰ xdx.		
	9. Obtain the area of a loop of the curve y^2	$(a^2+x^2)=x^2(a^2-x^2)$	2)			
	Find the volume of the solid formed by the	he revolution o	f the cycloid x=	$a(\theta + \sin \theta)$		
•	10. Solve the differential equation: $\frac{dy}{dx} = \frac{y}{x} + \frac{y}{x}$	$-\tan\frac{y}{x}$				
	11. Find the general solution of $y=Px+x^4p^2$					
	12. Solve $(D^2-2D+5)y = e^{2x}sinx$					
	13. Solve $x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4$	0-				
	A radio active material has an initial mas the amount of the material at any time t.	s 100mg. After	two years, it is	left to 75mg.	Find	
and a second	 What does the equation 3x²+3y²+2xy=2 angle 45° with the original axes. 	2 become when	n the axes are t	urned throug	h an	
	15. Obtain the equation of hyperbola in stand	lard form.			and the second	
	16. Find the center for the conic $3x^2+8xy-3y^2$	-40x-20y+50=	0.			

TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2076 AshwinExam.Exam.Enck2076 Ashwin22 Year/Part 1/121Subject - Engineering Mathematics I (SH 401)• Candidates are required to give their answers in their own words as far as practicable. • Atempt All questions. • The figures in the margin indicate Full Marks. • Assume suitable data if necessary.• If $y = sin(msin^{-1}x)$, show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$, where suffices of y denote the respective order of derivatives of y.• State Lagrange's mean value theorem. Verify it for the function $y = sin x cn \left[-\frac{\pi}{2}, \frac{\pi}{2} \right]$. Is this theorem valid for the function $y = tan x on [0, \pi]$?• Find the asymptotes of the curve $(x + y)^2(x + 2y + 2) = x + 9y - 2$.• Find the pedal equation of the curve $y^2 = 4a(x + a)$.• Evaluate, if possible $\int_0^{\beta} ln x dx$.• Apply differentiation under integral sign to evaluate $\int_0^{\infty} \frac{e^{-w} sin x}{x} dx$ and then show that $\int_0^{\infty} \frac{sin x}{x} dx = \frac{\pi}{2}$.• Define Beta and Gamma function and use it to show that, $\int_0^{x/2} cos^4 30 sin^2 60 d0 = \frac{5\pi}{192}$.• Find the volume of the solid formed by the revolution of the cardioid $r = a(1 + cos 0)$ about the initial line.• Solve the differential equation $\frac{dy}{dx} + y cot x = 2 cos x$.	115.
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2076 AshwinExam.BE Full MarksFull Marks80 Programme All (Except BAR) Pass Marks22 22 22 22 22 22 22 22 22 22 23 24 <br< th=""><th><u>ITS.</u> -</th></br<>	<u>ITS.</u> -
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERINGExam.Exam.Full Narks80Examination Control DivisionProgramme Programme All (Except BAR)Pass Marke322076 Ashwin2076 AshwinYear /Part4/1 (Except BAR)Pass Marke31Subject: - Engineering Mathematics I (SH 401) \checkmark Candidates are required to give their answers in their own words as far as practicable. \checkmark Attempt All questions. \checkmark The figures in the margin indicate Full Marks. \checkmark Assume suitable data if necessary.1. If $y = \sin(m \sin^{-1} x)$, show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$, where 	115. -
INSTITUTE OF ENGINEERING Examination Control Division 2076 Ashwin 2076 Ashwin 2077 Attempt 40 2077 Attempt 40 2077 Assume suitable data if necessary. 2076 Ashwin 2076 Ashwin 2077 Ashwin 2076 Ashwin 2076 Ashwin 2077 Ashwin 2076 Ashwin 2077 Ashwin 2076 Ashwin 2077 Ashwin 2076 Ashwin 2076 Ashwin 2076 Ashwin 2076 Ashwin 2076 Ashwin 2077 Ashwin 2076 Ashwin 2077 Ashwin 2077 Ashwin 2077 Ashwin 2077 Ashwin 2077 Ashwin 2077 Ashwin 207	hrs.
Examination Control DivisionTogrammeAll (Exception of the second	- -
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 Evaluate x→0 (tanx/x)^{1/x} Find the asymptotes of the curve (x+y)²(x+2y+2)=x+9y-2. Find the pedal equation of the curve y² = 4a(x+a). Evaluate, if possible ∫₀^e ℓn xdx. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. Define Beta and Gamma function and use it to show that, ∫₀^{n/6} cos⁴ 30 sin² 60 dθ = 5π/192. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. Solve the differential equation dy/dx + y cot x = 2 cos x. 	+3+1]
 3. Evaluate x→0 ((m/x)/x) 4. Find the asymptotes of the curve (x+y)²(x+2y+2)=x+9y-2. 5. Find the pedal equation of the curve y² = 4a(x+a). 6. Evaluate, if possible ∫₀^e ℓn xdx. 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	
 4. Find the asymptotes of the curve (x+y)²(x+2y+2)=x+9y-2. 5. Find the pedal equation of the curve y² = 4a(x+a). 6. Evaluate, if possible ∫₀^e ℓn xdx. 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[5]
 4. Find the asymptotes of the curve (x + y)² (x + 2y + 2) = x + 9y - 2. 5. Find the pedal equation of the curve y² = 4a(x + a). 6. Evaluate, if possible ∫₀^e ℓn xdx. 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[5]
 5. Find the pedal equation of the curve y² = 4a(x+a). 6. Evaluate, if possible ∫₀^e ℓn xdx. 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + ycot x = 2 cos x. 	[5]
 6. Evaluate, if possible ∫₀⁶ ℓn xdx. 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x dx and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[3]
 7. Apply differentiation under integral sign to evaluate ∫₀[∞] e^{-ax} sin x/x and then show that ∫₀[∞] sin x/x dx = π/2. 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[5]
$\int_{0}^{\infty} \frac{\sin x}{x} dx = \frac{\pi}{2}.$ 8. Define Beta and Gamma function and use it to show that, $\int_{0}^{\pi/6} \cos^{4} 3\theta \sin^{2} 6\theta \ d\theta = \frac{5\pi}{192}.$ 9. Find the volume of the solid formed by the revolution of the cardioid $r = a(1 + \cos \theta)$ about the initial line. 10. Solve the differential equation $\frac{dy}{dx} + y \cot x = 2 \cos x.$	
 8. Define Beta and Gamma function and use it to show that, ∫₀^{π/6} cos⁴ 3θ sin² 6θ dθ = 5π/192. 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[4+1]
 9. Find the volume of the solid formed by the revolution of the cardioid r = a(1 + cos θ) about the initial line. 10. Solve the differential equation dy/dx + y cot x = 2 cos x. 	[5]
about the initial line. 10. Solve the differential equation $\frac{dy}{dx} + y \cot x = 2 \cos x$.	
10. Solve the differential equation $\frac{dy}{dx} + y \cot x = 2 \cos x$.	[5]
du 2 a	. [5]
11. If p stands for $\frac{dy}{dx}$, then solve the differential equation $y - 2px + ayp^2 = 0$.	[5]
12. Solve the differential equation $(D^2 - 2D + 5) y = e^{2x} \sin x$.	[5
13. Solve the differential equation $(x^2D^2 + xD + 1)y = sin(logx^2)$	
14. Define ellipse and obtain the equation of ellipse in standard form.	[5]
15. Prove that the locus of a point which moves in such a way that the difference of its distances from the point (5, 0) and (-5, 0) is 2 is a hyperbola.	[5 [5
16. Describe and sketch the graph of the conic $r = \frac{10}{3 + 2\sin\theta}$	[5 [5 ; [5

TRIBHUVAN UNIVERSITY	Exam.	BE	Full Marks	.80	
INSTITUTE OF ENGINEERING	Programme	All (Except BAE)	Pass Marks	32	
2075 Chaitra	Year / Part	I/I	Time	3 hrs.	
Subject: - Engineer	ing Mathema	atics I (SH 401)	and the second se		
 ✓ Candidates are required to give their ans	swers in their o	wn words as far as	practicable.		
✓ Attempt <u>All</u> questions.					
✓ <u>All</u> questions carry equal marks.					
\checkmark Assume suitable adia if necessary.	-(2n+1)ry	$-(n^2 + a^2)v = 0$		-	
1. If $y = e^{-x}$, then prove that $(1-x)y_{n+1}$	$y_{n+2} = (2n+1)xy_{n+1}$	$(n + \alpha)y_n = 0$			
2. Assuming the validity of expansion	, find the ex	xpansion of log()	$1+e^{\circ}$) by usi	ng	
Machlaurin's Theorem.					
3. Evaluate: $x \rightarrow 0 \left(\frac{\sin x}{\sin x}\right)^{x}$					-
(x)					
4. Find the asymptotes of the curve:					
$y^2 = \frac{(a-x)^2}{2}x^2$					
$a^2 + x^2$					
5. Show that for the ellipse $\frac{x}{a^2} + \frac{y}{b^2} = 1$, t	the radius of c	urvature at the extr	remity of maj	or	
axis is equal to half of the latus rectum.					
(5) Show that $\int_{-1}^{1} \cot^{-1}(1-x+x^2) dx = \frac{\pi}{2} - \log \frac{\pi}{2}$	2.				
0. Show that Joee (1 with just 2					
7. Evaluate by using the rule of differentiation	on under the si	gn of integration			
 $\int \frac{\log(1+a\cos x)}{dx} dx$					
o cosx					
8 Prove that: $\int_{-\infty}^{\infty} \sqrt{y} e^{-y^2} dy \times \int_{-\infty}^{\infty} \frac{e^{-y^2}}{dy} dy = \frac{\Pi}{-\pi}$	-				
$\int \frac{1}{y_0} \sqrt{y} = \int \frac{1}{y_0} \sqrt{y} = \frac{1}{y_0} \sqrt{y} = \frac{1}{2\sqrt{2}}$	1		THE R. L.		
9. Find the surface area of solid generated by	y revolution of	cycloid.			
$x = a(\theta + \sin \theta), y = a(1 + \cos \theta)$ ab	out its axis.				
10. Solve the differential equation:					
$\frac{dy}{dy} + \frac{1}{2}\sin 2y = x^3\cos^2 y$					
dx x	2				
11. If p denotes $\frac{dy}{dx}$, then solve $p^3 - 4xyp + 8$	$y^2 = 0$.				
$d^2y dy x^2 x^{3x}$		endere infrans			
12. Solve: $\frac{dx^2}{dx^2} - \frac{dx}{dx} + y = x e$					
13 Solve: $x^2 \frac{d^2y}{d^2y} - x \frac{dy}{d^2y} + y = \log x$					-
dx^2 dx		•			2
14. Derive the standard equation of an ellipse.			2 2		-
15. Find the condition that the line $x\cos\alpha + y$	ysin $\alpha = p$ to t	ouch hyperbola $\frac{x}{x}$	$\frac{y^2}{2} - \frac{y^2}{L^2} = 1$ and	d	
also find point of contact		a	U		
 16. Find the centre, length of	axes and	l eccentricity	of coni	с	
$9x^2 + 4xy + 6y^2 - 22x - 16y + 9 = 0.$					
	OR				
Describe and sketch the graph of polar equa	ation: $r =$	4			
	1 + 3	cosθ			

022 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2074 Chaitra

Exam.	Regular				
Level	BE	Full Marks	80		
Programme	ALL (Except B. Arch)	Pass Marks	32		
Year / Part	I/I	Time	3 hrs.		

Subject: - Engineering Mathematics I (SH401)

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.
- 1. State Leibnitz theorem. If $\log y = \tan^{-1} x$, then show that

$$(1+x^{2})y_{n+2} + (2nx+2x-1)y_{n+1} + (n^{2}+n)y_{n} = 0$$
[1+4]

- 2. State Rolle's theorem. Is the theorem true when the function is not continuous at the end points? Justify your answer. Verify Rolle's theorem for $f(x) = x^2 5x + 6$ on [2,3]. [1+2+2]
- 3. State L-Hospital's rule. Evaluate $x \xrightarrow{\lim}{\to} 1(2-x)^{\tan\left(\frac{\pi x}{2}\right)}$ [1+4]

4. Find the asymptotes of the curve
$$(x + y)^2(x+2y+2) = x+9y-2$$
 [5]

5. Find the pedal equation of the ellipse
$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1.$$
 [5]

6. Evaluate the integral
$$\int_{-1}^{1} \frac{1}{x^2} dx$$
 [5]

7. Apply the rule of differentiation under integral sign to evaluate $\int_0^\infty \frac{e^{-ax} \sin x}{x} dx$ and hence deduce that $\int_0^\infty \frac{\sin x}{x} dx = \frac{\pi}{2}$ [5]

- 8. Define Beta function. Apply Beta and Gamma function to evaluate $\int_0^{2a} x^5 \sqrt{2ax x^2} dx$ [5]
- 9. Find the area common to the circle r = a and the cordioid $r = a(1 + \cos\theta)$ [5]

10. Through what angle should the axes be rotated to reduce the equation

 $3x^2 + 2xy + 3y^2 - \sqrt{2x} = 0$ into one with the xy term missing? Also obtain the transformed equation. [2+3]

[5]

[5]

- 11. Derive the equation of an ellipse in standard form. [5]
- 12. Find the product of semi-axis of the conic $x^2 4xy + 5y^2 = 2$

OR

Describe and sketch the graph of conic $r = \frac{12}{3 + 2\cos\theta}$

13. Solve the differentiate equation of
$$(x^2 - y^2)dx + 2xydy = 0$$
 [5]

14. Solve:
$$y = yp^2 + 2px$$
 where $p = \frac{dy}{dx}$ [5]

15. Solve $(D^2 - 6D + 9)y = x^2e^{2x}$

01 TRIBHUVAN UNIVERSITY	Exam.	B	ack 🦯 👘	
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80
Examination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
2074 Ashwin	Year / Part	I/I	Time	3 hrs.

Subject: - Engineering Mathematics I (SH401)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.
- 1. State Leibnitz's theorem on heigher order derivative. If $y = e^{a \tan^{-1} x}$, prove that $(1 + x^2)y_{n+2} + (2nx + 2x a)y_{n+1} + n(n+1)y_n = 0$
- 2. State difference between Roll's Theorem and Lagrange's Mean value theorem. Verify Lagrange's mean value theorem for f(x) = x(x-1)(x-2) when $x \in \left[0, \frac{1}{2}\right]$.
- 3. Define inderminate form of a function. Evaluate

$$x \xrightarrow{\lim} 0\left(\frac{\tan x}{x}\right)^{1/x^{2}}$$

- 4. Define asymptote to a curve. Find the asymptotes of curve $y^3 + 2xy^2 + x^2y y + 1 = 0$.
- 5. Find radius of curvature of the curve $x^3 + y^3 = 3axy$ at origin.

OR

Find the pedal equation of the polar curve $r^m = a^m \cos \theta$.

- 6. Integrate : $\int_{0}^{\frac{\pi}{2}} \frac{\cos x \, dx}{(1 + \sin x)(2 + \sin x)}$
- 7. Apply differentiation under integral sign to evaluate $\int_0^\infty \frac{e^{-ax} \sin x}{x} dx$.
- 8. Define Beta and Gamma function. Use them to evaluate $\int_0^{2a} x^5 \sqrt{2ax x^2} dx$.
- 9. Show that the area of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ is $\frac{3}{8}\pi a^2$.

OR

Find the volume of the solid formed by the revolution of the cardoid $r = a(1 + \cos\theta)$ about the initial line.

- 10. Solve: $(1 + y^2)dx = (\tan^{-1} y x)dy$
- 11. Solve: $y = px \sqrt{m^2 + p^2}$ where $p = \frac{dy}{dx}$.

12. Solve: $(D^2 + 2D + 1)y = e^x + x^2$.

1

13. Solve: Solve: $x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4$.

OR

A resistance of 100 ohms, an inductance of 0.5 Henry are connected in series with a battery of 20 volts. Find the current in the circuit as a function of time.

14. What does the equation of lines $7x^2 + 4xy + 4y^2 = 0$ become when the axes are the bisectors of the angles between them?

15. Derive the equation of hyperbola in standard form.

16. Find the foci and eccentricity of the conic $x^2 + 4xy + y^2 - 2x + 2y - 6 = 0$.

OR

Describe and sketch the graph of the conic $r = \frac{12}{6 + 2\sin\theta}$.

01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2073 Shrawan

Exam.	New Back (2066 & Later Batch)				
Level	BE	Full Marks	80		
Programme	ALL (Except B.Arch)	Pass Marks	32		
Year / Part	I/I	Time	3 hrs.		

Subject: - Engineering Mathematics I (SH401)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.
- 1. State Leibnitz's theorem. If $y = (\sin^{-1} x)^2$, show that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$
- 2. Verify Rolle's Theorem for $f(x) = \log \frac{x^2 + ab}{(a+b)x}$; $x \in [a,b]$. How does Rolle's Theorem differ from Lagrange's mean value theorem.
- 3. Evaluate $\lim_{x \to 0^+} (\frac{\sin x}{x})^{\frac{1}{x}}$
- 4. Find the asymptotes to the curve $y^3 + 2xy^2 + x^2y y + 1 = 0$
- 5. Find the radius of curvature at origin for the curve $x^3 + y^3 = 3axy$.
- 6. Show that $\int_{0}^{\pi} x \log(\sin x) dx = \frac{\pi^2}{2} \log \frac{1}{2}$

7. Apply the rule of differentiation under integral sign to evaluate $\int_{0}^{\infty} \frac{e^{-ax} \sin x}{x} dx$ and hence

deduce that
$$\int_{0}^{\frac{\sin x}{x}} dx = \frac{\pi}{2}$$

- 8. Define Beta function. Apply Beta and Gamma function to evaluate $\int_{-\infty}^{2a} x^5 \sqrt{2ax x^2} dx$
- 9. Find the volume generated by revolution of astroid $x^{2/3} + y^{2/3} = a^{2/3}$ about x-axis.
- 10. What does the equation $3x^2 + 3y^2 + 2xy = 2$ becomes when the axes are turned through an angle of 45° to the original axes?
- 11. Find center, length of axes, eccentricity and directrices of the conic

$$3x^2 + 8xy - 3y^2 - 40x - 20y + 50 = 0$$

OR

Describe and sketch the conic $r = \frac{12}{2 - 6\cos\theta}$

12. Deduce standard equation of ellipse.

13. Solve the differential equation:
$$(1 + y^2) + (x - e^{\tan^{-1}y})\frac{dy}{dx} = 0$$

14. Solve:
$$xp^2 - 2yp + ax = 0$$
 where $p = \frac{dy}{dx}$

15. Solve:
$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{2x} \cdot \sin x$$

16. Resistance of 100 ohms an inductance of 0.5 Henry are connected in series with bottom.

01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2072 Chaitra

Exam.	Regular				
Level	BE	Full Marks	80		
Programme	ALL (Except B. Arch)	Pass Marks	32		
Year / Part	I/I	Time	3 hrs		

Subject: - Engineering Mathematics I (SH401)

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. State Leibnitz's theorem. If $y = (x^2 - 1)^n$, then prove that

$$(x^{2}-1)y_{n+2} + 2xy_{n+1} - n(n-1)y_{n} = 0$$

- 2. Assuming the validity of expansion, expand log(1 + sin x) by Maclaurin's therom.
- 3. Evaluate $x \xrightarrow{\lim} 0 \frac{(1+x)^{1/x} e}{x}$
- 4. Find the asymptotes of the curve: $x(x-y)^2 3(x^2 y^2) + 8y = 0$
- 5. Find the radius of curvature at any point (r, θ) for the curve $a^2 = r^2 \cos 2\theta$

6. Show that:
$$\int_{0}^{\pi} \frac{x \sin x}{1 + \cos^{2} x} dx = \frac{\pi^{2}}{4}$$

7. Apply differentiation under integral sign to evaluate $\int_0^{\pi/2} \log \frac{a + b \sin x}{a - b \sin x} \frac{dx}{\sin x}$

8. Define Gamma function. Apply Beta and Gamma function to evaluate:

$$\int_0^{\pi/6} \cos^2 6\theta . \sin^4 3\theta = \frac{7\pi}{192}$$

- 9. Find the area inclosed by $y^2(a-x) = x^3$ and its asymptotes.
- 10. If the axes be turned through and angle of $\tan^{-1}2$, what does the equation $4xy-3x^2-a^2=0$ become?
- 11. Find the center, length of axes, eccentricity and directrices of the conic.

 $2x^2 + 3y^2 - 4x - 12y + 13 = 0$

OR

Describe and sketch the graph of the conic $r = \frac{10}{3 + 2\cos\theta}$

12. Deduce standard equation of hyperbola.

13. Solve the differential equation:
$$x \log x \frac{dy}{dx} + y = 2 \log x$$

- 14. Solve: $(x-a)p^2 + (x-y)p y = 0$: where $p = \frac{dy}{dx}$
- 15. Solve: $(D^2 D 2)y = e^x + \sin 2x$
- 16. Find a current i(t) in the RLC circuit assuming zero initial current and charge q, if R = 80 ohms, L = 20 Henry, C = 0.01 Fardays and E = 100 volts.

01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2072 Kartik

Exam.	New Back (2066 & Later Batch				
Level	BE	Full Marks	80		
Programme	All (Except B.Arch)	Pass Marks	32		
Year / Part	I/I /	Time	3 hrs.		

Subject: - Engineering Mathematics I (SH401)

✓ Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt <u>All</u> questions.

<u>All</u> questions carry equal marks.

Assume suitable data if necessary.

1. If $y = (\sin^{-1} x)^2$, then show that:

i) $(1-x^2)y_2 - xy_1 - 2 = 0$ ii) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n \frac{2}{3}y_n = 0$

2. State Rolle's Theorem and verify the theorem for $f(x) = \frac{x(x+3)}{e^{x/2}}$; $x \in [-3,0]$

3. Evaluate: $x \to 0 \left(\frac{\tan x}{-x}\right)^{1/3}$

4. Find the asymptotes of the curve: $(a + x)^2(b^2 + x^2) = x^2 \cdot y^2$

5. Find the pedal equation of the curve $r^2 = a^2 \cos 2\theta$

6. Evaluate $\int_{0}^{\pi/4} \frac{(\sin x \pm \cos x)}{(9+16\sin 2x)} dx$

7. Use Beta Gamma function to evaluate $\int_0^{2a} x^5 \sqrt{2ax - x^2} dx$

8. Evaluate by using the rule of differentiation under the sign of integration.

 $\int_0^\infty \frac{e^{-x} \sin bx}{x} dx$

9. Find the area of one loop of the curve $r = a \sin 3\theta$

OR

- Find-the volume of the solid formed by the revolution of the cardioid $r = a (1+\cos\theta)$ about the initial line.

Find center and eccentricity of conic $x^2 + 4xy + y^2 - 2x + 2y - 6 = 0$

OR

P.97

Describe and sketch the graph of the equation $r = \frac{10}{3 + 2\cos\theta}$

- 10. Find the condition that the line lx + my + n = 0 may be a normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- 11. Show that the pair of tangents drawn from the center of a hyperbola are its asymptotes.
- 12. Solve the differential equation: $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$
- 13. Solve: $y-2px+ayp^2=0$ where $p=\frac{dy}{dx}$
- 14. Solve the differential equation: $x \frac{dy}{dx} + y \log y = xy e^{x}$
- 15. Solve the differential equation: $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} 4y = x^2$

UI IKIBHUVAN UNIVERSITY	01 IRIBHUVAN UNIVERSITY Exam. New Bac		16 AV DALCO BOR	
	Level	BE	Full Marks	80
Examination Control Division	Programme	All (Except B.Arch),	Pass Marks	32
2071 Shawan shares and	Year / Part	1.41	Time	3 h
Gulind Train	ing Made	L' T /~~~		
Subject: - Engineeri	illy Mathema	tics I (SH401)		
✓ Candidates are required to give their ans	swers in their o	wn words as far as pra	cticable.	
Attempt <u>All</u> questions.				
✓ The figures in the margin indicate <u>Full</u> .	<u>Marks</u> .			· ·
• Assame sunable data ij necessary.				
1 If $y = \log \left(y + \sqrt{a^2 + y^2} \right)$, then show the	$(a^2 + x^2)y$	$\pm (2n \pm 1) x x = (n^2 x)$	-0	Гs
$1. II y = \log(x + \sqrt{a} + x) y$	$a + x y_{n+2}$	$+(2.11+1)Xy_{n+1}+11y$	n = 0	[
2. State and prove Logrange's Mean Value	e theorem.			[5
		s de la la la construction de la construcción de la construcción de la construcción de la construcción de la c	a de la composición de La composición de la c	
3. Evaluate: $x \rightarrow \prod_{i=1}^{n} (\sin x)$				[5
4. Find the asymption of the curve $a^2y^2 + \frac{1}{2}$	$x^2y^2 - a^2x^2 + 2$	$2ax^3 - x^4 = 0$		[5
				•
5. Find the radius of curvature at the origin	1 IOT THE CURVE }	$x^2 + y^2 = 3axy$	للل المنظمة المعالية المعالية معالية المعالية المعا	
6. Evaluate $\int \frac{\sqrt{x}}{\sqrt{x}} dx$				۲۲
$\int_{0}^{j}\sqrt{x}+\sqrt{a-x}$				د <u>ا</u>
	م م	$e^{-ax} - e^{-bx}$	· ·	
7. Apply differentiation under integral sign	to evaluate \int_{0}^{1}	dx		[5
π . The first first product of the second se				
8 Using Gamma function show that sin^4	$x \cos^2 x dx = \frac{3}{2}$	$\pi-4$		[5
J O		192		[-,
0 Find the step bounded by the surve $x^2 -$	- Av and the lin	· ·· · · · · · ·		•
9. Find the area bounded by the curve $x =$	- 4 y and the find	t x:=4y-⇒Z:satas), a.e.		
	OR			
Find the volume of the solid generated	by the revolution	ion of the cardioid r =	= a (1-cosθ)	÷ .
about the initial line.				
10. Solve: $\sin x \frac{dy}{dx} + y \cos x = x \sin x$				[5]
dx				• • •
11 Solve: $xp^2 - 2wp + ax = 0$ where $p = \frac{dy}{dx}$	•			[5]
dx				[-]
$-12 \text{ Solve: } \frac{d^2y}{dx^2 + y} = x^2 e^{3x}$			· · · ·	[5]
dx^2 dx dx			•	[2]
$d^2 y dy$				
13. Solve: $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$			•	[5]
			1 -	
.14. Transform the equation $x^2 - 2xy + y^2$	+x-3y=0 to	o axes through the	point (-1,0)	
parallel to the lines bisecting the angles b	etween the orig	inal axes.		[5]
15. Find the center, length of axe	es and the	eccentricity of t	he ellipse	
$2x^2 + 3y^2 - 4x - 12y + 13 = 0$				[5]
16. Find the length of axes and ecentricity of	the conic	•		[5]
$14x^2 - 4xy + 11y^2 - 44x - 58y + 71 =$: 0		•	
	OP	•		
e t-	OA			
e^{2}	12			

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TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING **Examination Control Division** 2071 Chaitra

Exam.	Regular	
Level	BE Full Marks	80
Programme	All (Except B.Arch) Pass Marks	32
Year/Part	I/I Time	3 hrs.

Subject: - Engineering Mathematics I (SH401)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.
- 1. State Leibnity's theorem on Leigher derivatives:
 - If $y = sin (m sin^{-1} x)$ then show that

$$1-x^{2}) y_{n+2} - (2n+1) xy_{n+1} + (m^{2}-n^{2})y_{n} = 0$$

2. Assuming the validity of expansion, find the expansion of the function $\frac{e^x}{1+e^x}$ by Maclaurin's theorem.

3. Evaluate
$$\lim_{x\to 0} \frac{xe^x - (1+x)\log(1+x)}{xe^x}$$

- Find the asymptotes of the curve $y^3 + 2xy^2 + x^2y y + 1 = 0$
- 5. Find the radius of curvature of the curve $y = x^2(x-3)$ at the points where the tangent is parallel to x-axis

OR

Find the pedal equation of the curve $r^2 = a^2 \cos 2\theta$

Show that $\int_0^{\infty} \frac{dx}{x + \sqrt{a^2 - x^2}} = \frac{\Pi}{4}$

7. Apply differentiation under integral sign to evaluate $\int_{0}^{1/2} \frac{dx}{(a^{2} \sin^{2} x + b^{2} \cos^{2} x)^{2}}$

- Use gamma function to prove that $\int_0^1 \frac{dx}{(1-x^6)^{1/6}} = \Pi/3$ 8.
- 9. Find the volume or surface area of solid generated by revolving the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about its base.

- 10. If the line lx+my+n=0 is normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ then show that
 - $\frac{a^2}{l^2} + \frac{b^2}{m^2} = \frac{(a^2 b^2)^2}{n^2}$
- 11. Solve the locus of a point which moves in such a way that the difference of its distance from two fixed points is constant is Hyperbola.
- 12. Solve the differential equation $x \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} = 6x$
- 13. Solve $(x^2D^2 + xD + 1)y = sin(log x^2)$
- 14. Solve, $y = yp^2 + 2px$ where $p = \frac{dy}{dx}$
- 15. Solve: $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{2x} \sin x$

16. Describe and sketch the graph of the equation $r = \frac{10}{2-3\sin\theta}$

OR

Show that the conic section represented by the equation

 $14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$ is an ellipse. Also find its center, eccentricity, latus rectuns and foci

01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division 2071 Shawan

Exam.	New Back (2066 & Later Batch)					
Level	3E Full Marks 80					
Programme	All (Except B.Arch)	Pass Marks	32			
Year / Part	1/1	Time	3 hrs.			

Subject: - Engineering Mathematics I (SH401)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
 ✓ Attempt <u>All</u> questions.
 ✓ The figures in the margin indicate <u>Full Marks</u>.
 ✓ Assume suitable data if necessary.
 1. If y = log(x + √a² + x²), then show that (a² + x²)y_{n+2} + (2n + 1)xy_{n+1} + n²y_n = 0
 2. State and prove Logrange's Mean Value theorem.
 3. Evaluate: x → Π (sin x)^{tan x}
- 4. Find the asymption of the curve $a^2y^2 + x^2y^2 a^2x^2 + 2ax^3 x^4 = 0$ [5]
- 5. Find the radius of curvature at the origin for the curve $x^3 + y^3 = 3axy$ 6. Evaluate $\int_{a}^{a} \frac{\sqrt{x}}{\sqrt{x} + \sqrt{a - x}} dx$

7. Apply differentiation under integral sign to evaluate
$$\int_{0}^{\infty} \frac{e^{-ax} - e^{-bx}}{x} dx$$
 [5]

- 8. Using Gamma function show that $\int_{0}^{\frac{\pi}{4}} \sin^4 x \cos^2 x \, dx = \frac{3\pi 4}{192}$ [5]
- 9. Find the area bounded by the curve $x^2 = 4y$ and the line x = 4y 2OR

Find the volume of the solid generated by the revolution of the cardioid $r = a (1-\cos\theta)$ about the initial line.

10 Solve:
$$\sin x \frac{dy}{dx} + y \cos x = x \sin x$$
 [5]

11. Solve:
$$xp^2 - 2yp + ax = 0$$
 where $p = \frac{dy}{dx}$ [5]

12.80 lve:
$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x^2 e^{3x}$$
 [5]

13 Solve:
$$x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = \log x$$
 [5]

14 Transform the equation $x^2 - 2xy + y^2 + x - 3y = 0$ to axes through the point (-1,0) parallel to the lines bisecting the angles between the original axes. [5]

15. Find the center, length of axes and the eccentricity of the ellipse $2x^2 + 3y^2 - 4x - 12y + 13 = 0$

46. Find the length of axes and ecentricity of the conic

$$14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$$

OR

Describe and sketch the conic $r = \frac{12}{2 - 6\cos\theta}$

[5] [5]

[5]

[5]

[5]

[5]



01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

Exam.		Regular	
Level	BE	Full Marks	80
Programme	All (Except B.Arch)	Pass Marks	32
Year / Part	Ι/Ι	Time	3 hrs.

2070 Chaitra

Subject: - Engineering Mathematics I (SH401)

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. If Y = Sin(m sin⁻¹x), then show that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$

- 2. Apply Maclaurin's series to find the expansion of $\frac{e^x}{1+e^x}$ as far as the term in x^3
- 3. Evaluate: $x \xrightarrow{\lim}{\to} a \left(2 \frac{x}{a}\right)^{\operatorname{Tan} \frac{\pi x}{2a}}$

4. Find the asymptotes of the curve $x(x-y)^2 - 3(x^2 - y^2) + 8y = 0$

5. Find the pedal equation of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$

6. Apply the method of differentiation under integral sign to evaluate $\int_{-\infty}^{\infty} \frac{\log(1 + a^2 x^2)}{1 + b^2 x^2} dx$

7. Show that $\int_{0}^{\infty} \frac{\log(1+x^2)}{1+x^2} dx = \pi \log 2$

8. Use Gamma function to prove that $\int_{0}^{1} \frac{dx}{(1-x^{6})^{\frac{1}{6}}} = \frac{\pi}{3}$

9. Find the area of two loops of the curve $a^2y^2 = a^2y^2 - x^4$

)*R*

Find the volume of the solid formed by the revolution of the cycloid $x = a (\theta + \sin \theta)$, $y = a (1 - \cos \theta)$ about the tangent at the vertex.

<u>10.</u> Solve the differential equation $(1 + y^2) + (x - e^{\tan^{-1}y})\frac{dy}{dx} = 0$

Solve: $y - 3px + ayp^2 = 0$

12. Solve: $(D^2 - 2D + 5)y = e^{2x} . \sin x$

- 13. A resistance of 100 Ohms, an inductance of 0.5 Henry are connected in series with a battery 20 volts. Find the current in the circuit as a function of time.
- 14. What does the equation $3x^2 + 3y^2 + 2xy = 2$ becomes when the axes are turned through an angle 45° to the original axes.
- 15. Show that the locus of a point which moves in such a way that the differences of its distance from two fixed points is constant is a hyperbola.
- 16. Find the center, length of the axes and eccentricity of the conic $2x^2 + 3y^2 4x 12y + 13 = 0$

OR

Describe and sketch the graph of the polar equation of conic $r = \frac{10 \csc \theta}{2 \csc \theta + 3}$

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01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING

Examination Control Division 2069 Chaitra

Exam.	Regular			
Level	BE	Full Marks	80	
Programme	All (Except B.Arch)	Pass Marks	32	
Year / Part	1/1	Time	3 hrs.	

Subject: - Engineering Mathematics I (SH401)

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- ✓ <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.

$$= 1. \text{ If } y = \log (x + \sqrt{(a^2 + x^2)}) \text{ show that } (a^2 + x^2)y_{n+2} + (2n+1)xy_{n+1} + n^2y_n = 0$$

2. State and prove Lagrange's Mean Value theorem.

- 3. If $x \xrightarrow{\lim} 0 \frac{a \sin x \sin 2x}{\tan^3 x}$ is finite, find the value of a and the limit.
- 4. Find asymptotes of $(x^2-y^2)^2 2(x^2+y^2) + x-1 = 0$
- (5. 'Find the radius of curvature at any point (x,y) for the curve $x^{2/3}+y^{2/3}=a^{2/3}$

6. Prove that
$$\int_0^\infty \frac{\sin bx}{x} dx = \frac{\pi}{2} (b > 0)$$

7. Use Beta and Gamma function to evaluate $\int_0^{2a} x^5 \sqrt{2ax - x^2} dx$

- 8. Evaluate $\int_0^\infty \frac{e^{-x} \sin bx}{x} dx$ by using the rule of differentiation under the sign of integration.
- 9. Find the volume of the solid formed by the revolution of the cardiod $r = a (1+\cos\theta)$ about initial line.

OR

Find the area bounded by the curve $x^2y = a^2$ (a-y) and the x-axies

10. Solve the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$

-11. Solve the differential equation $x \frac{dy}{dx} + y \log y = xye^{x}$

12. Solve the differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = e^x + e^{-x}$

13. Solve $y = px - \sqrt{m^2 + p^2}$ where $p = \frac{dy}{dx}$

A resistance of 100 ohms, an inductance of 0.5 henry are connected in series with a battery of 20 volts. Find the current in the circuit as a function of time.

14. Solve that locus of a point which moves in such a way that the differences of it distance from two fixed point is constant is Hyperbola.

OR

- -15. Find the equation of ellipse of the form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ where a>b
 - 16. Describe and sketch the graph of the equation $r = \frac{4 \sec \theta}{2 \sec \theta 1}$



	INSTITUTE OF ENGINEEDING	Exam.	New Back	2066 Batch &	Later
Ex	amination Control Division	Programme	All (Except	Pass Marks	32
	2068 Shrawan	Year / Part	I/I	Time	3 hrs
-	Bulling Th		L		L
•	Subject: - Engir	leering Mathe	ematics I		
	Candidates are required to give their ans Attempt <u>All</u> questions. <u>All</u> questions carry equal marks. Assume suitable data if necessary.	wers in their o	wn words as fa	r as practicable	•
1.	If $y = \log(x + \sqrt{a^2 + x^2})$, show that $(a^2 + \sqrt{a^2 + x^2})$	$(+x^2)y_{n+2} + (2n)y_{n+2}$	$+1)xy_{n+1} + n^{2}$	$^{2}y_{n}=0.$	
2.	State and prove Lagrange's mean value	theorem.	· .		
3⁄.	Evaluate: $\frac{\lim_{x \to 0} \left(\frac{\tan x}{x}\right)^{1/x}}{x}.$				
5	Find the asymptotes of the curve $(x^2 - y^2)$	$^{2})(x + 2y + 1) +$	$\mathbf{x} + \mathbf{y} + 1 = 0.$		
₹⁄	Show that for the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$,	the radius of	curvature at t	he extremity o	f ihe
	major axis is equal to half of the latus re-	ctum.			
б.	Evaluate: $\int_{0}^{\pi/2} \frac{dx}{1 + \sqrt{\tan x}}.$				
J.	Use Gamma function to prove that $\int_{0}^{1} \frac{1}{(1-1)^{1/2}}$	$\frac{dx}{(x^6)^{1/6}} = \frac{\pi}{3}.$	•		
8.	Using method of differentiation under in	tegral sign, eva	situate: $\int_{0}^{\infty} \frac{e^{-x} \sin x}{x}$	$\frac{1}{2}$ dx.	
9.	Find the area bounded by the cardioid, r	$= a(1 + \cos\theta).$			
		OR			
	Find the volume of the solid former $y = a(1 + \cos\theta)$ about its base.	d by revolvin	g the cycloid	$\mathbf{x} = \mathbf{a}(\mathbf{\theta} + \mathbf{s})$	inθ),
10.	Find the angle through which the $ax^2 + 2hxy + by^2 = 0$ may become an equation	axes must b uation having o	e turned so o term involvi	that the equ ng xy.	ation
И.	Obtain the equation of an ellipse in the s	tandard form.			
12.	Find the centre of the conic $3x^2 + 8xy -$	$3y^2 - 40x - 20y$	y + 50 = 0.13	2	
13.	Solve the differential equation $(x + y + 1)$	$d) \frac{dy}{dx} = 1.$			
14.	Find the general solution of the different	ial equation: p	$3-4xyp+8y^2$	= 0.	
15.	Find the general solution of the different	ial equation: (I	$D^2 + 2D + 1)y =$	$= e^x \cos x$.	
16.	Newton's law of cooling states that " proportional to the difference of temper Supposing water at a temperature 10 maintained at 30°C, find when the temperature	The temperatu ratures between 0°C cools to erature of wate	re of an object n the object an 80°C in 10 1 r will become	et changes at a ad its surroundi ninutes, in a 40°C.	ngs". 1907 1907
		OP	_ , , , , ,		

Solve:
$$x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 6y = x$$



01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

2068 Baishakh

ſ	Exam.	Regular / Back		
	Level	BE	Full Marks	80
	Programme	All (Except B.Arch.)	Pass Marks	32
	Year / Part	I/I	Time	3 hrs.

Subject: - Engineering Mathematics I

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- \checkmark <u>All</u> questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. If $y = a \cos(\log x) + b \sin(\log x)$. Prove that $x^2 \cdot y_{n+2} + (2n+1)x \cdot y_{n+1} + (n^2 + 1)y_n = 0$.

2. State and prove Rolle's theorem.

3. Determine the values of a, b, c, so that
$$\frac{\text{Lt}}{x \to 0} \frac{(a + b \cos x)x - c \sin x}{x^5} = 1.$$

- 4. Find the asymptotes of the curve $(x + y)^2 (x + 2y + 2) = x + 9y 2$.
- 5. If e_1 and e_2 be the radii of curvature at the ends of a focal chord of the parabola $y^2 = 4ax$, prove that $e_1^{-2/3} + e_2^{-2/3} = (2a)^{-2/3}$.
- 6. Prove that $\int_{0}^{\pi} \frac{x \tan x}{\sec x + \cos x} dx = \frac{\pi^2}{4}.$
- 7. Apply the method of differentiation under integral sign to prove:

$$\int_{0}^{\pi/2} \frac{\mathrm{d}x}{\left(a^2 \sin^2 x + b^2 \cos^2 x\right)^2} = \frac{\pi(a^2 + b^2)}{4a^3 b^3}.$$

8. Use Gamma function to prove that $\int_{0}^{1} \frac{dx}{(1-x^{6})^{1/6}} = \frac{\pi}{3}.$

9. Find the area bounded by the curve $x^2y = a^2(a-y)$ and the x axis.

OR

Find the volume of the solid formed by revolving the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about its base.

10. Solve the differential equation: $(1 + y^2) + (x - e^{\tan^{-1}y}) \frac{dy}{dx} = 0.$

11. Solve: $xy^2(p^2 + 2) = 2py^3 + x^3$

12. solve : $(D^2 - 2D + 5)y = e^{2x}$.sinx

13. Solve the differential equation: $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = e^x$

14. What does the equation $3x^2 + 3y^2 + 2xy = 2$ becomes when the axes are turned through an angle 45° to the original axis.

OR

Describe and Sketch the graph of the conic $r = \frac{10 \cos ec\theta}{2 \cos ec\theta + 3}$.

- 15. Derive the equation of Ellipse in the standard form.
- 16. Find the equation of tangents to the hyperbola $3x^2 4y^2 = 12$ which are perpendicular to the line x y + 2 = 0. Also find the point of contact.

01 TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING Examination Control Division

Exam.	Regular/Back			
Level	BE	Full Marks	80	
Programme	All (Except B.Arch.)	Pass Marks	32	
Year / Part	I/I	Time	3 hrs.	

2067 Ashadh

Subject: - Engineering Mathematics I

- \checkmark Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt <u>All</u> questions.
- The figures in the margin indicate <u>Full Marks</u>.
- ✓ Assume suitable data if necessary.

1. If $y = e^{a \tan^{-1}x}$, prove that $(1 + x^2)y_{n+2} + (2nx + 2x - a)y_{n+1} + n(n+1)y_n = 0.5$

- 2. State and prove Lagrange's mean value theorem.
- 3. Evaluate $\lim_{x \to 0} \left(\frac{\sin x}{x} \right)^{\frac{1}{x}}$
- 4. Find the asymptotes of the curve $(x + y)^2(x + 2y + z) = x + 9y 2$.
- 5. Find the radius of curvature of the curve $r = a(1 \cos\theta)$.
- 6. Apply the method of differentiation under integral sign to evaluate $\int_0^\infty \frac{\tan^{-1}(ax)}{x(1+x^2)} dx$.

7.=Prove that
$$\int_0^{\pi/2} \frac{\sin^2 x \, dx}{\sin x + \cos x} = \frac{1}{\sqrt{2}} \log(\sqrt{2} + 1).$$

8. Use Gamma function to prove $\int_0^{\pi/6} \cos^4 3\theta \cdot \sin^2 6\theta = \frac{5\pi}{192} \cdot 5$

- 9. Find, by method of integration, the area of the loop of the curve $ay^2 = x^2 (a x)$.
- 10. Solve the differential equation $(1 + x^2)\frac{dy}{dx} + y = e^{\tan^{-1}x}$. 5
- 11. Solve $y = yp^2 + 2px$, where p = dy/dx 5
- 12. Solve $(D^2 3D + 2)y = x^2 + x$ 5
- 13. Newton's law of cooling states that the temperature of an object changes at a rate proportional to the difference of temperature between the object and its surroundings. Supposing water at 100°C cools to 80°C in 10 minutes, in a room temperature of 30°C, find when the temperature of water will become 40°C?

OR

Solve the differential equation $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = \log x$.

14. Find the condition that the line lx + my + n = 0 may be the tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.5$

- 15. Derive the equation of a hyperbola in standard form. 5
- 16. Find the centre, length of axes and eccentricity of the conic $2x^2 + 3y^2 4x 12y + 13 = 0$.

OR

Identify and sketch the conic $r = \frac{10}{3 + 2\cos\theta}$

03	TRIBHUVAN UNIVERSITY	Exam.	R	legular / Back	
INSTI	TUTE OF ENGINEERING	Level	BE	Full Marks	80
Examin	ation Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
•	2066 Shrawan	Year / Part	I/I	Time	3 hrs.
	Suhiect	- Mathematic	د آ		
	1				
 ✓ Candid ✓ Attemp ✓ The fig ✓ Assum 	nates are required to give their an ot <u>All</u> questions. gures in the margin indicate <u>Full</u> e suitable data if necessary.	swers in their o' <u>Marks</u> .	wn words as fa	ar as practicable	
J. Find th	ne angle of intersection of the pai	$r of curves r^n = OP$	a ⁿ cos nθ and i	$a^n = a^n \sin n\theta.$	• •
If $y = a$	a cos(log x) + b sin (log x). Prove	that $x^2y_{n+2} + ($	$(2n + 1)x.y_{n+1}$	$+(x^2+1)y_n=0$)
. State-F	Rolle's theorem and verify it for t	he function f(x)	$= x.(x + 3).e^{-1}$	$(x/2), x \in [-3, 0]$	
.3, Evalua	tte: $\alpha t = \frac{(1+x)^{1/x} - e}{(1+x)^{1/x} - e}$	• •			ſ
4 A cone	$x \rightarrow 0$ x is circumscribed to a sphere of	radius r Show t	hat when the s	volume of the co	neic
least it	s altitude is 4r and its semivertica	al angle is sin ⁻¹	1/3).		
5/ Find th	he asymptotes of the curve $(x+y)^2$	(x + 2y + 2) =	x + 9y - 2 .		
Find th	ie radius of curvature at any poin	OR t (x y) for the c	urve $x^{2/3} + y^{2/3}$	$a^{3} = a^{2/3}$	
6. Integra	ate any three	. (,)) 202 022 0	<u> </u>		ž –
.æ)∫-($\frac{x.e^x}{1+x)^2} dx \qquad \qquad (b)$	$\int_0^1 \frac{\log(1+x)}{1+x^2}$.dx		
∝ C) ∫ -∞	$\frac{e^{x}}{1+e^{2x}} dx$	$\int_0^{\pi/2} \frac{\sqrt{\cot x}}{1+\sqrt{\cot x}}$.dx		
7. Evalua	tte $\int_{1}^{4} x^3 dx$ by the method of sum	mation.			
8. Obtain	reduction formula for $\int \cot^n x d$	x and hence into	egrate $\int \cot^7 x$	dx.	tan ang
		OR	J	•	
Using	Gamma function show that $\int_{0}^{\infty} e^{-x}$	$\int_{0}^{4} x^{2} dx \times \int_{0}^{\infty} e^{-x^{4}}$	$dx = \frac{\pi}{8\sqrt{2}}$	· · · · · · · ·	
9. Find tl	ne area bounded by the cardioid r	$= a(1 + \cos\theta)$			
Find $y = a(1)$	the volume of the solid form $1 + \cos\theta$ about its base.	OR ed by revolvin	g the cycloid	$d x = a(\theta +$	sinθ),
10. Solve	any three of the following differe	ential equations.			
a) x ($dy - y dx = \sqrt{x^2 + y^2} . dx$	b) $x \frac{dy}{dx} + y$.	log y = xy.e [≭]		
c) y- 1.1. If the becom	- 2px + ap ² .y = 0 axes be turned through an angle les?	d) $(D^2 - 3D)$ tan $\theta = 2$. What	$(+2)y = e^{x}$ It does the equ	nation 4xy – 3x	$a^{2} = a^{2}$
12. Find th	he equation of an ellipse in the st	andard form.			
13. If e ₁ a	and e_2 are the eccentricities of t	he hyperbola, a	ind it conjuga	té respectively.	Then
prove	that $\frac{\frac{1}{e_1^2}}{e_1^2} + \frac{1}{e_2^2} = 1.$			• •	
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03 TRIBHUVAN UNIVERSITY	Exam.	Re	gular/Back	
INSTITUTE OF ENGINEERING	Level	BE	Full Marks	80
Examination Control Division	Programme	All (Except B.Arch.)	Pass Marks	32
2065 Shrawan	Year / Part	I/I	Time	3 hrs.

Subject: - Mathematics I Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt <u>All</u> questions.

✓ The figures in the margin indicate *Full Marks*.

Assume suitable data if necessary.

1. Find the angle between the curves
$$r = a \sin 2\theta$$
, $r = a \cos 2\theta$. [5]

0

If
$$y = (x^2 - 1)^n$$
, prove that $(x^2 - 1)y_{n+2} + 2xy_{n+1} - n(n+1)y_n =$

- 2. State and prove Lagrange's mean value theorem.
- 3. Evaluate: $\lim_{x \to 0} (\cot x)^{\frac{1}{\log x}}$
- Find the surface of the right circular cylinder of greatest surface which can be inscribed in a sphere of radius r. [5]
- 5. Find the asymptotes of the curve $(x^2 y^2)(x + 2y + 1) + x + y + 1 = 0.$ [5]

OR

Show that the radius of curvature for the curve $r^m = a^m \cos m\theta$ is $\frac{a^m}{(m+1)r^{m-1}}$.

6. Integrate any three:

a)
$$\int \frac{\cos x \, dx}{(1 + \sin x)(2 + \sin x)}$$

b)
$$\int_{0}^{\pi/4} \frac{\sin 2\theta \, d\theta}{\sin^4 \theta + \cos^4 \theta}$$

c)
$$\int_{0}^{\pi/2} \frac{\sqrt{\cot x} \, dx}{1 + \sqrt{\cot x}}$$

d)
$$\int_{-1}^{2} \frac{dx}{x^3}$$

7. Evaluate $\int_0^1 \sqrt{x} dx$ by the method of summation.

8. Obtain a reduction formula for $\int \sec^n x \, dx$ and hence find $\int \sec^6 x \, dx$.

OR

Evaluate $\int_0^1 \frac{\mathrm{d}x}{(1-x^6)^{1/6}}$

9. Find the area of a loop of the curve $a^2y^2 = a^2x^2 - x^4$.

Find the volume of the solid generated by revolving the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ about the axis of x.

- 10. Solve any three of the following differential equations.
 - a) (3y-7x+7)dx + (7y-3x+3)dy = 0
 - b) $\cos x \, dy = y(\sin x y)dx$
 - c) $p^2 py + x = 0$; where $p = \frac{dy}{dx}$

d)
$$(D^2 - 3D + 2)y = x^2 + x$$

- 11. Find the changed form of the equation $3x^2 + 3y^2 + 2xy = 2$ when the axes are turned through 45° the origin remaining fixed. [5]
- 12. The line x + y = 0 is a directrix of an ellipse, the point (2,2) is the corresponding focus. If the eccentricity be 1/3, find the equation of the other directrix.
- 13. Find the equation of the hyperbola in the standard form

[5]

[15]

[5] [5]

[10]

[5]

[5]

[5]

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