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SUMMER- 19 EXAMINATION

Subject Name: Applied Mathematics

Model Answer

Subject Code:

22210

Important Instructions to Examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		Attempt any <u>FIVE</u> of the following:	10
	a)	If $f(x) = 3x^2 - 5x + 7$ show that $f(-1) = 3f(1)$ Ans $f(-1) = 15$ $f(1) = 5$ $\therefore 3f(1) = 15$ $\therefore f(-1) = 3f(1)$	02 1 1
	b)	State whether the function $f(x) = 3x^4 + x^2 + 5 - 3\cos x + 2\sin^2 x$ is even or odd Ans $f(x) = 3x^4 + x^2 + 5 - 3\cos x + 2\sin^2 x$ $\therefore f(-x) = 3(-x)^4 + (-x)^2 + 5 - 3\cos(-x) + 2\sin^2(-x)$ $\therefore f(-x) = 3x^4 + x^2 + 5 - 3\cos x + 2\sin^2 x$ $\therefore f(-x) = f(x)$ \therefore function is an even function	02 $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
c)	Find $\frac{dy}{dx}$ if $y = e^x \cdot \sin^{-1} x$ Ans $y = e^x \cdot \sin^{-1} x$ $\therefore \frac{dy}{dx} = e^x \cdot \frac{1}{\sqrt{1-x^2}} + \sin^{-1} x \cdot e^x$	02 1+1	



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1.	c)	$\therefore \frac{dy}{dx} = e^x \left(\frac{1}{\sqrt{1-x^2}} + \sin^{-1} x \right)$	
	d)	Evaluate $e^{\int 2 \log x \, dx}$	02
	Ans	$e^{\int 2 \log x \, dx}$ $= e^{2 \int \log x \, dx}$ $= e^{2 \int \log x \cdot 1 \, dx}$ $= e^{2 \left(\log x \cdot x - \int x \cdot \frac{1}{x} \, dx \right)}$ $= e^{2 \left(x \log x - \int 1 \, dx \right)}$ $= e^{2(x \log x - x) + c}$ $= e^{2x(\log x - 1) + c}$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
e)	Evaluate $\int \sin^2 x \, dx$	02	
Ans	$\int \sin^2 x \, dx$ $= \frac{1}{2} \int 2 \sin^2 x \, dx$ $= \frac{1}{2} \int (1 - \cos 2x) \, dx$ $= \frac{1}{2} \left(x - \frac{\sin 2x}{2} \right) + c$	<p>1</p> <p>1</p>	
f)	Find the area under the curve $y = x^2$ from $x = 0$ to $x = 3$ with x -axis.	02	
Ans	$\text{Area } A = \int_a^b y \, dx$ $= \int_0^3 x^2 \, dx$ $= \left[\frac{x^3}{3} \right]_0^3$	<p>1/2</p> <p>1/2</p>	



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1.	f)	$= \left(\frac{3^3}{3} - 0 \right)$ $= 9$	½
	g)	<p>Express $z = 1 - i$ in Polar form.</p> <p>Ans $z = 1 - i$</p> <p>$\therefore x = 1, y = -1$</p> <p>$\therefore r = z = \sqrt{x^2 + y^2} = \sqrt{(1)^2 + (-1)^2} = \sqrt{2}$</p> <p>$\theta = 2\pi - \tan^{-1} \left(\left \frac{y}{x} \right \right) = 2\pi - \tan^{-1} \left(\left \frac{-1}{1} \right \right) = 2\pi - \tan^{-1}(1)$</p> <p>$\theta = 2\pi - \frac{\pi}{4} = \frac{7\pi}{4}$</p> <p>$\therefore$ Polar form is $z = r(\cos \theta + i \sin \theta)$</p> <p>$\therefore 1 - i = \sqrt{2} \left(\cos \left(\frac{7\pi}{4} \right) + i \sin \left(\frac{7\pi}{4} \right) \right)$</p>	½ 02 ½
2.		<p>Attempt any <u>THREE</u> of the following:</p>	12
	a)	<p>Find $\frac{dy}{dx}$ if $x^2 + y^2 = 4xy$</p> <p>Ans $x^2 + y^2 = 4xy$</p> <p>$\therefore 2x + 2y \frac{dy}{dx} = 4 \left(x \frac{dy}{dx} + y \cdot 1 \right)$</p> <p>$\therefore 2x + 2y \frac{dy}{dx} = 4x \frac{dy}{dx} + 4y$</p> <p>$\therefore (2y - 4x) \frac{dy}{dx} = 4y - 2x$</p> <p>$\therefore \frac{dy}{dx} = \frac{4y - 2x}{2y - 4x}$</p> <p>$\therefore \frac{dy}{dx} = \frac{2y - x}{y - 2x}$</p>	04 2 1 1



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2.	b)	<p>If $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$, find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{2}$</p> <p>Ans $x = a(\theta + \sin \theta)$ $y = a(1 - \cos \theta)$</p> $\frac{dx}{d\theta} = a(1 + \cos \theta)$ $\frac{dy}{d\theta} = a(0 + \sin \theta) = a \sin \theta$ $\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{a \sin \theta}{a(1 + \cos \theta)}$ $\frac{dy}{dx} = \frac{\sin \theta}{1 + \cos \theta}$ <p>at $\theta = \frac{\pi}{2}$</p> $\therefore \frac{dy}{dx} = \frac{\sin \frac{\pi}{2}}{1 + \cos \frac{\pi}{2}} = 1$	<p>04</p> <p>1+1</p> <p>1</p> <p>1</p>
	c)	<p>Find the radius of curvature of the curve $\sqrt{x} + \sqrt{y} = 1$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$</p> <p>Ans $\sqrt{x} + \sqrt{y} = 1$</p> $\therefore \frac{1}{2\sqrt{x}} + \frac{1}{2\sqrt{y}} \frac{dy}{dx} = 0$ $\therefore \frac{dy}{dx} = -\frac{\sqrt{y}}{\sqrt{x}}$ $\therefore \frac{d^2y}{dx^2} = -\frac{\left(\sqrt{x} \frac{1}{2\sqrt{y}} \frac{dy}{dx} - \sqrt{y} \frac{1}{2\sqrt{x}}\right)}{x}$ $\therefore \frac{d^2y}{dx^2} = -\frac{\left(\frac{\sqrt{x}}{2\sqrt{y}} \cdot -\frac{\sqrt{y}}{\sqrt{x}} - \frac{\sqrt{y}}{2\sqrt{x}}\right)}{x} = -\frac{\left(\frac{-1}{2} - \frac{\sqrt{y}}{2\sqrt{x}}\right)}{x}$ <p>at $\left(\frac{1}{4}, \frac{1}{4}\right)$</p>	<p>04</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>



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2.	d)	$\therefore \frac{dy}{dx} = -\frac{\sqrt{1/4}}{\sqrt{1/4}} = -1$ $\therefore \frac{d^2y}{dx^2} = -\frac{\left(\frac{-1}{2} - \frac{\sqrt{1/4}}{2\sqrt{1/4}}\right)}{1/4} = 4$ $\therefore \text{Radius of curvature} = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}} = \frac{\left[1 + (-1)^2\right]^{3/2}}{4}$ $= 0.707$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
		<p>Find the maximum and minimum value of $x^3 - 9x^2 + 24x$</p> <p>Let $y = x^3 - 9x^2 + 24x$</p> <p>d) Ans</p> $\therefore \frac{dy}{dx} = 3x^2 - 18x + 24$ $\therefore \frac{d^2y}{dx^2} = 6x - 18$ <p>Consider $\frac{dy}{dx} = 0$</p> $3x^2 - 18x + 24 = 0$ $\therefore x = 2 \text{ or } x = 4$ <p>at $x = 2 \quad \therefore \frac{d^2y}{dx^2} = 6(2) - 18 = -6 < 0$</p> <p>$\therefore y$ is maximum at $x = 2$</p> $y_{\max} = (2)^3 - 9(2)^2 + 24(2) = 20$ <p>at $x = 4 \quad \therefore \frac{d^2y}{dx^2} = 6(4) - 18 = 6 > 0$</p> <p>$\therefore y$ is minimum at $x = 4$</p> $y_{\min} = (4)^3 - 9(4)^2 + 24(4) = 16$	<p>04</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
		<p>Note: If students attempted to solve the question give appropriate marks.</p>	



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3.	b)	Find $\frac{dy}{dx}$ if $y = x^x + (\sin x)^x$	04
	Ans	<p>Let $u = x^x$</p> <p>Taking log on both sides,</p> $\therefore \log u = \log x^x$ $\therefore \log u = x \log x$ $\therefore \frac{1}{u} \frac{du}{dx} = x \frac{1}{x} + \log x \cdot 1$ $\therefore \frac{1}{u} \frac{du}{dx} = 1 + \log x$ $\therefore \frac{du}{dx} = u(1 + \log x)$ <p>Let $v = (\sin x)^x$</p> <p>taking log on both sides,</p> $\therefore \log v = \log (\sin x)^x$ $\therefore \log v = x \log \sin x$ $\therefore \frac{1}{v} \frac{dv}{dx} = x \frac{1}{\sin x} \cdot \cos x + \log \sin x \cdot 1$ $\therefore \frac{1}{v} \frac{dv}{dx} = x \cot x + \log \sin x$ $\therefore \frac{dv}{dx} = v(x \cot x + \log \sin x)$ $\therefore \frac{dy}{dx} = \frac{du}{dx} + \frac{dv}{dx}$ $\therefore \frac{dy}{dx} = x^x (1 + \log x) + (\sin x)^x (x \cot x + \log \sin x)$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>
	c)	If $y = e^{3\sec x + 4\tan x}$ find $\frac{dy}{dx}$	04
	Ans	<p>$y = e^{3\sec x + 4\tan x}$</p> $\therefore \frac{dy}{dx} = e^{3\sec x + 4\tan x} (3\sec x \cdot \tan x + 4\sec^2 x)$	4



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3.	d)	Evaluate $\int \frac{\sec^2 x}{(1 + \tan x)(3 + \tan x)} dx$	04
	Ans	$\int \frac{\sec^2 x}{(1 + \tan x)(3 + \tan x)} dx$ <p>Put $\tan x = t$</p> $\therefore \sec^2 x dx = dt$ $\therefore \int \frac{1}{(1+t)(3+t)} dt$ $\frac{1}{(1+t)(3+t)} = \frac{A}{1+t} + \frac{B}{3+t}$ $\therefore 1 = A(3+t) + B(1+t)$ $\therefore \text{Put } t = -1, A = \frac{1}{2}$ $\text{Put } t = -3, B = \frac{-1}{2}$ $\therefore \frac{1}{(1+t)(3+t)} = \frac{1/2}{1+t} - \frac{1/2}{3+t}$ $\therefore \int \frac{1}{(1+t)(3+t)} dt = \int \left(\frac{1/2}{1+t} - \frac{1/2}{3+t} \right) dt$ $= \frac{1}{2} \log(1+t) - \frac{1}{2} \log(3+t) + c$ $= \frac{1}{2} \log(1 + \tan x) - \frac{1}{2} \log(3 + \tan x) + c$	<p>1</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>1/2</p>
		<p>OR</p> $\int \frac{\sec^2 x}{(1 + \tan x)(3 + \tan x)} dx$ <p>Put $\tan x = t$</p> $\therefore \sec^2 x dx = dt$ $\int \frac{1}{(1+t)(3+t)} dt$	1



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3.	d)	$= \int \frac{1}{t^2 + 4t + 3} dt$ $\text{Third Term} = \frac{4^2}{4} = 4$ $= \int \frac{1}{t^2 + 4t + 4 - 4 + 3} dt$ $= \int \frac{1}{(t+2)^2 - 1} dt$ $= \frac{1}{2} \log \left \frac{t+2-1}{t+2+1} \right + c$ $= \frac{1}{2} \log \left \frac{t+1}{t+3} \right + c$ $= \frac{1}{2} \log \left \frac{\tan x + 1}{\tan x + 3} \right + c$	<p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p>
4.		<p>Attempt any <u>THREE</u> of the following:</p> <p>a) Evaluate $\int x \tan^{-1} x dx$</p> <p>Ans $\int \tan^{-1} x \cdot x dx$</p> $= \tan^{-1} x \int x dx - \int \left(\int x dx \frac{d}{dx} (\tan^{-1} x) \right) dx$ $= \tan^{-1} x \frac{x^2}{2} - \int \frac{x^2}{2} \frac{1}{1+x^2} dx$ $= \frac{x^2}{2} \tan^{-1} x - \frac{1}{2} \int \frac{x^2}{1+x^2} dx$ $= \frac{x^2}{2} \tan^{-1} x - \frac{1}{2} \int \left(\frac{1+x^2-1}{1+x^2} \right) dx$ $= \frac{x^2}{2} \tan^{-1} x - \frac{1}{2} \int \left(\frac{1+x^2}{1+x^2} - \frac{1}{1+x^2} \right) dx$ $= \frac{x^2}{2} \tan^{-1} x - \frac{1}{2} \int \left(1 - \frac{1}{1+x^2} \right) dx$ $= \frac{x^2}{2} \tan^{-1} x - \frac{1}{2} (x - \tan^{-1} x) + c$	<p>12</p> <p>04</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>



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4.	b)	<p>Evaluate $\int \frac{dx}{4+5\cos x}$</p> <p>Ans $\int \frac{dx}{4+5\cos x}$</p> <p>Put $\tan \frac{x}{2} = t$, $dx = \frac{2dt}{1+t^2}$, $\cos x = \frac{1-t^2}{1+t^2}$</p> $= \int \frac{\frac{2dt}{1+t^2}}{4+5\left(\frac{1-t^2}{1+t^2}\right)}$ $= \int \frac{2dt}{4(1+t^2)+5(1-t^2)}$ $= 2 \int \frac{dt}{4+4t^2+5-5t^2}$ $= 2 \int \frac{dt}{9-t^2}$ $= 2 \int \frac{dt}{(3)^2-t^2}$ $= 2 \frac{1}{2(3)} \log \left \frac{3+t}{3-t} \right + c$ $= \frac{1}{3} \log \left \frac{3+\tan \frac{x}{2}}{3-\tan \frac{x}{2}} \right + c$	<p>04</p> <p>1</p> <p>½</p> <p>½</p> <p>½</p> <p>1</p> <p>½</p>
	c)	<p>Evaluate $\int \frac{2x^2+5}{(x-1)(x+2)(x+3)} dx$</p> <p>Ans $\int \frac{2x^2+5}{(x-1)(x+2)(x+3)} dx$</p> <p>Consider $\frac{2x^2+5}{(x-1)(x+2)(x+3)} = \frac{A}{x-1} + \frac{B}{x+2} + \frac{C}{x+3}$</p> <p>$\therefore 2x^2+5 = A(x+2)(x+3) + B(x-1)(x+3) + C(x-1)(x+2)$</p> <p>Put $x = 1$</p> <p>$\therefore 7 = 12A$</p>	<p>04</p> <p>½</p>



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4.	c)	$\therefore A = \frac{7}{12}$ $\text{Put } x = -2 \quad \Rightarrow 13 = -3B$ $\therefore B = \frac{-13}{3}$ $\text{Put } x = -3 \quad \Rightarrow 23 = 4C$ $\therefore C = \frac{23}{4}$ $\therefore \int \frac{2x^2 + 5}{(x-1)(x+2)(x+3)} dx = \int \left(\frac{\frac{7}{12}}{x-1} + \frac{\frac{-13}{3}}{x+2} + \frac{\frac{23}{4}}{x+3} \right) dx$ $= \frac{7}{12} \log(x-1) - \frac{13}{3} \log(x+2) + \frac{23}{4} \log(x+3) + c$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2+1/2+1/2</p>
	d)	<p>Evaluate $\int \frac{1}{\sqrt{16-6x-x^2}} dx$</p> <p>Ans $\int \frac{1}{\sqrt{16-6x-x^2}} dx$</p> $\text{Third Term} = \frac{(6)^2}{4} = 9$ $= \int \frac{1}{\sqrt{16+9-9-6x-x^2}} dx$ $= \int \frac{1}{\sqrt{25-(9+6x+x^2)}} dx$ $= \int \frac{1}{\sqrt{(5)^2 - (x+3)^2}} dx$ $= \sin^{-1} \left(\frac{x+3}{5} \right) + c$ <p>OR</p> $\int \frac{1}{\sqrt{16-6x-x^2}} dx$	<p>04</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>



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4.	d)	$= \int \frac{1}{\sqrt{-(x^2 + 6x - 16)}} dx$ $\text{Third Term} = \frac{(6)^2}{4} = 9$ $= \int \frac{1}{\sqrt{-(x^2 + 6x + 9 - 9 - 16)}} dx$ $= \int \frac{1}{\sqrt{-(x^2 + 6x + 9 - 25)}} dx$ $= \int \frac{1}{\sqrt{-[(x+3)^2 - (5)^2]}} dx$ $= \int \frac{1}{\sqrt{(5)^2 - (x+3)^2}} dx$ $= \sin^{-1}\left(\frac{x+3}{5}\right) + c$	<p>1/2</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1</p>
	e)	<p>Evaluate $\int_0^{\pi/2} \frac{dx}{1 + \cot x}$</p> <p>Ans $\int_0^{\pi/2} \frac{dx}{1 + \cot x}$</p> $\therefore I = \int_0^{\pi/2} \frac{1}{1 + \frac{\cos x}{\sin x}} dx$ $\therefore I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx \text{ -----(1)}$ $\therefore I = \int_0^{\pi/2} \frac{\sin(\pi/2 - x)}{\sin(\pi/2 - x) + \cos(\pi/2 - x)} dx$ $\therefore I = \int_0^{\pi/2} \frac{\cos x}{\cos x + \sin x} dx \text{ -----(2)}$ <p>add (1) and (2)</p>	<p>04</p> <p>1/2</p> <p>1</p>



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4.	e)	$\therefore I + I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx + \int_0^{\pi/2} \frac{\cos x}{\cos x + \sin x} dx$ $2I = \int_0^{\pi/2} \frac{\sin x + \cos x}{\sin x + \cos x} dx$ $2I = \int_0^{\pi/2} 1 dx$ $2I = [x]_0^{\pi/2}$ $2I = \frac{\pi}{2} - 0$ $\therefore I = \frac{\pi}{4}$	<p>1/2</p> <p>1</p> <p>1</p>
5.		<p>Attempt any TWO of the following:</p> <p>a) Find the area between the curves $y = x$ and $y = x^2$</p> <p>Ans</p> $y = x$ $y = x^2$ $\therefore x - x^2 = 0$ $\therefore x(1 - x) = 0$ $\therefore x = 0, 1$ $\therefore A = \int_0^1 (x - x^2)$ $A = \left(\frac{x^2}{2} - \frac{x^3}{3} \right)_0^1$ $A = \left(\frac{1}{2} - \frac{1}{3} \right)$ $\therefore A = \frac{1}{6} \text{ or } 0.167$	<p>04</p> <p>2</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
5.		<p>Attempt the following</p> <p>b)(i) Find the order and degree of the differential equation</p>	<p>12</p>



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5.	b)	$\frac{d^2y}{dx^2} = \sqrt{1 + \frac{dy}{dx}}$	03
	(i)	$\frac{d^2y}{dx^2} = \sqrt{1 + \frac{dy}{dx}}$	
	Ans	Squaring both sides, we get $\left(\frac{d^2y}{dx^2}\right)^2 = 1 + \frac{dy}{dx}$ $\therefore \text{Order} = 2$ $\text{Degree} = 2$	
	b)(ii)	Solve $\frac{dy}{dx} + y \cot x = \cos ecx$ Ans $\frac{dy}{dx} + y \cot x = \cos ecx$ Comparing with $\frac{dy}{dx} + Py = Q$ $P = \cot x$, $Q = \cos ecx$ Integrating factor $IF = e^{\int \cot x dx} = e^{\log(\sin x)} = \sin x$ $y \cdot IF = \int Q \cdot IF dx + c$ $\therefore y \sin x = \int \cos ecx \cdot \sin x dx$ $\therefore y \sin x = \int 1 dx$ $\therefore y \sin x = x + c$	03
	c)	If $L \frac{di}{dt} = 30 \cdot \sin(10\pi t)$, find i in terms of t , given that $L = 2$ and $i = 0$ at $t = 0$	06
	Ans	$L di = 30 \sin(10\pi t) dt$ $\int L di = \int 30 \sin(10\pi t) dt$	
		$Li = 30 \left(\frac{-\cos(10\pi t)}{10\pi} \right) + c$	



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5.	c)	$Li = \frac{-3\cos(10\pi t)}{\pi} + c$ <p>at $t = 0, i = 0$</p> $L(0) = \frac{-3\cos(0)}{\pi} + c$ $0 = \frac{-3}{\pi} + c$ $\therefore c = \frac{3}{\pi}$ $\therefore Li = \frac{-3\cos(10\pi t)}{\pi} + \frac{3}{\pi}$ <p>at $L = 2$</p> $\therefore 2i = \frac{-3\cos(10\pi t)}{\pi} + \frac{3}{\pi}$ $\therefore i = \frac{3}{2\pi}(-\cos(10\pi t) + 1)$	<p>½</p> <p>1</p> <p>½</p> <p>1</p>
6.		<p>Attempt any <u>TWO</u> of the following:</p> <p>a) Attempt the following</p> <p>(i) Express $\frac{2 - \sqrt{3}i}{1 + i}$ in $x + iy$ form.</p> <p>Ans</p> $\frac{2 - \sqrt{3}i}{1 + i}$ $= \frac{2 - \sqrt{3}i}{1 + i} \times \frac{1 - i}{1 - i}$ $= \frac{2 - 2i - \sqrt{3}i + \sqrt{3}i^2}{1 - i^2}$ $= \frac{2 - (2 + \sqrt{3})i + \sqrt{3}(-1)}{1 - i^2}$ $= \frac{2 - (2 + \sqrt{3})i - \sqrt{3}}{1 + 1}$	<p>04</p> <p>03</p> <p>1</p> <p>½</p> <p>½</p>



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Model Answer

Subject Code:

22210

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)(i)	$\frac{(2-\sqrt{3})-(2+\sqrt{3})i}{2}$ $= \frac{(2-\sqrt{3})}{2} - \frac{(2+\sqrt{3})i}{2}$	1
	a)(ii)	<p>Find $L\{e^{-4t}t^2\}$</p> <p>Ans $L\{e^{-4t}t^2\}$</p> $L\{t^2\} = \frac{2!}{s^3} = \frac{2}{s^3}$ $\therefore L\{e^{-4t}t^2\} = \frac{2}{(s+4)^3}$	03 1 2
	b)	<p>Find $L^{-1}\left\{\frac{2s^2-4}{(s+1)(s-2)(s-3)}\right\}$</p> <p>Ans $L^{-1}\left\{\frac{2s^2-4}{(s+1)(s-2)(s-3)}\right\}$</p> <p>Let</p> $\frac{2s^2-4}{(s+1)(s-2)(s-3)} = \frac{A}{s+1} + \frac{B}{s-2} + \frac{C}{s-3}$ $2s^2-4 = (s-2)(s-3)A + (s+1)(s-3)B + (s+1)(s-2)C$ <p>Put $s = -1$</p> $\therefore -2 = 12A$ $\therefore A = -\frac{1}{6}$ <p>Put $s = 2$</p> $4 = -3B$ $\therefore B = -\frac{4}{3}$ <p>Put $s = 3$</p> $14 = 4C$	04 1 1



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Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	b)	$\therefore C = \frac{7}{2}$ $\therefore \frac{2s^2 - 4}{(s+1)(s-2)(s-3)} = \frac{-\frac{1}{6}}{s+1} + \frac{-\frac{4}{3}}{s-2} + \frac{\frac{7}{2}}{s-3}$ $\therefore L^{-1} \left\{ \frac{2s^2 - 4}{(s+1)(s-2)(s-3)} \right\} = -\frac{1}{6} L^{-1} \left\{ \frac{1}{s+1} \right\} - \frac{4}{3} L^{-1} \left\{ \frac{1}{s-2} \right\} + \frac{7}{2} L^{-1} \left\{ \frac{1}{s-3} \right\}$ $= -\frac{1}{6} e^{-t} - \frac{4}{3} e^{2t} + \frac{7}{2} e^{3t}$	1 1+1+1
	c)	<p>Solve using Laplace transform</p> $\frac{dx}{dt} + 2x = e^{-t}, \text{ given that } x(0) = 2$ <p>Ans $\frac{dx}{dt} + 2x = e^{-t}$</p> $\therefore L \left\{ \frac{dx}{dt} + 2x \right\} = L \{ e^{-t} \}$ $\therefore sL(x) - x(0) + 2L(x) = \frac{1}{s+1}$ $\therefore sL(x) - 2 + 2L(x) = \frac{1}{s+1}$ $\therefore (s+2)L(x) - 2 = \frac{1}{s+1}$ $\therefore (s+2)L(x) = \frac{1}{s+1} + 2$ $\therefore (s+2)L(x) = \frac{2s+3}{s+1}$ $\therefore L(x) = \frac{2s+3}{(s+1)(s+2)}$ $\therefore x = L^{-1} \left\{ \frac{2s+3}{(s+1)(s+2)} \right\}$ $\therefore \frac{2s+3}{(s+1)(s+2)} = \frac{A}{s+1} + \frac{B}{s+2}$ $\therefore 2s+3 = A(s+2) + B(s+1)$	06 1 1 1/2 1/2



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6.	c)	Put $s = -1$ $\therefore A = 1$ Put $s = -2$ $\therefore B = 1$ $\therefore \frac{2s+3}{(s+1)(s+2)} = \frac{1}{s+1} + \frac{1}{s+2}$ $\therefore L^{-1} \left\{ \frac{2s+3}{(s+1)(s+2)} \right\} = L^{-1} \left\{ \frac{1}{s+1} + \frac{1}{s+2} \right\}$ $= L^{-1} \left\{ \frac{1}{s+1} \right\} + L^{-1} \left\{ \frac{1}{s+2} \right\}$ $= e^{-t} + e^{-2t}$	 $\frac{1}{2}$ $\frac{1}{2}$ 1+1
<p><u>Important Note</u></p> <p><i>In the solution of the question paper, wherever possible all the possible alternative methods of solution are given for the sake of convenience. Still student may follow a method other than the given herein. In such case, first see whether the method falls within the scope of the curriculum, and then only give appropriate marks in accordance with the scheme of marking.</i></p> <p>-----</p> <p>-----</p>			