Zeal Education Society's

ZEAL POLYTECHNIC, PUNE.

NARHE | PUNE -41 | INDIA

FIRST YEAR (FY)

DIPLOMA IN MECHANICAL ENGINEERING

SCHEME: I **SEMESTER: II**

NAME OF SUBJECT: Applied Mathematics

Subject Code: 22206

MSBTE QUESTION PAPERS & MODEL ANSWERS

1. MSBTE SUMMER-18 EXAMINATION
2. MSBTE WINTER-18 EXAMINATION
3. MSBTE SUMMER-19 EXAMINATION
4. MSBTE WINTER-19 EXAMINATION

22206

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Figures to the right indicate full marks.

(4) Use of Non-programmable Electronic Pocket Calculator is permissible.

(5) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. **Attempt any FIVE of the following:** **10**

a) If, $f(x) = x^2 - x + 1$, then find $f(0) + f(3)$.

b) Show that, $f(x) = \dfrac{a^x + a^{-x}}{2}$ is an even function.

c) Find $\dfrac{dy}{dx}$, if $y = x^5 + 5^x + e^x + \log_2 x$

d) Evaluate, $\displaystyle\int \frac{1}{1 + \cos 2x}\, dx$

e) Evaluate, $\displaystyle\int x \cdot e^x \cdot dx$

f) Find area bounded by the curve $y = x^3$, x–axis and the ordinate $x = 1$ to $x = 3$.

g) If a fair coin is tossed three times, then find probability of getting exactly two heads.

Marks

2. Attempt any THREE of the following: 12

a) Find $\frac{dy}{dx}$ if, $e^x + e^y = e^{x+y}$

b) If, $x = a\cos^3\theta$ and $y = b\sin^3\theta$. Find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$

c) A telegraph wire hangs in the form of a curve $y = a.\log\left[\sec\left(\frac{x}{a}\right)\right]$. Where a is constant. Show that, radius of curvature at any point is $a\cdot\sec\left(\frac{x}{a}\right)$.

d) A beam is supported at the two ends and is uniformly loaded. The bending moment M at a distance x from the end is given by $M = \frac{W1}{2} \times x - \frac{W}{2} \times x^2$. Find the point at which M is maximum.

3. Attempt any THREE of the following: 12

a) Find the equation of tangent and normal to the curve $y = x^2$ at point (–1,1)

b) Find $\frac{dy}{dx}$ if, $y = x^{\sin x}$.

c) Find $\frac{dy}{dx}$ if, $y = \tan^{-1}\left(\frac{x}{1+12x^2}\right)$

d) Evaluate, $\int \frac{(\sin^{-1}x)^3}{\sqrt{1-x^2}}\,dx$.

4. Attempt any THREE of the following: 12

a) Evaluate, $\int \frac{e^x(x+1)}{\cos^2(x.e^x)}\,dx$.

b) Evaluate, $\int \frac{dx}{5 - 4\cos x}$.

c) Evaluate, $\int \tan^{-1}x.dx$.

d) Evaluate, $\int \frac{e^x \cdot dx}{(e^x - 1)(e^x + 1)}$.

e) Evaluate, $\int_0^{\pi/2} \frac{1}{1+\tan x}\,dx$

Marks

5. Attempt any TWO of the following: **12**

a) Find area bounded by the curve $y^2 = 4x$ and $x^2 = 4y$.

b) Attempt the following:

(i) Form a differential equation by eliminating arbitary constant if $y = A.\cos(\log x) + B\sin(\log x)$.

(ii) Solve, $x(1 + y^2)\,dx + y\cdot(1 + x^2)\,dy = 0$.

c) A particle starting with velocity 6 m/s. has an acceleration $(1 - t^2)$ m/s^2. When does it first come to rest? How far has it then travelled?

6. Attempt any TWO of the following: **12**

a) (i) An unbiased coin is tossed 5 times. Find probability of getting three heads.

(ii) Fit a poissons distribution for the following observations.

x_i	20	30	40	50	60	70
fi	8	12	30	10	6	4

b) If 2% of the electric bulbs manufactured by a company are defective. Find the probability that in sample of 100 bulbs

(i) 3 are defective

(ii) At least two are defective.

c) In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution is to be normal,

(i) How many students score between 12 and 15.

(ii) How many students score above 18.

Given

Frequency 0 to 0.8 = 0.2881

Frequency 0 to 0.4 = 0.1554

Frequency 0 to 1.6 = 0.4452.

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

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 FIVE of the following:**	**10**
	a)	If $f(x)=x^2-x+1$, find $f(0)+f(3)$	**02**
	Ans	$f(0)=(0)^2-0+1=1$	½
		$f(3)=(3)^2-3+1=7$	1
		$\therefore f(0)+f(3)=1+7$	
		$=8$	½
		--	
	b)	Show that $f(x)=\dfrac{a^x+a^{-x}}{2}$ is an even function	**02**
	Ans	$f(x)=\dfrac{a^x+a^{-x}}{2}$	
		$\therefore f(-x)=\dfrac{a^{-x}+a^{-(-x)}}{2}$	½
		$\therefore f(-x)=\dfrac{a^{-x}+a^{x}}{2}=\dfrac{a^x+a^{-x}}{2}$	½
		$\therefore f(-x)=f(x)$	½
		$\therefore$ function is even	½
		--	
	c)	Find $\dfrac{dy}{dx}$, if $y=x^5+5^x+e^x+\log_2 x$	**02**
	Ans	$y=x^5+5^x+e^x+\log_2 x$	

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	c)	$\therefore y = x^5 + 5^x + e^x + \frac{\log x}{\log 2}$ $\therefore \frac{dy}{dx} = 5x^4 + 5^x \log 5 + e^x + \frac{1}{\log 2}\frac{1}{x}$ $\therefore \frac{dy}{dx} = 5x^4 + 5^x \log 5 + e^x + \frac{1}{x\log 2}$	 2
	d) Ans	Evaluate $\int \frac{1}{1+\cos 2x}\, dx$ $\int \frac{1}{1+\cos 2x}\, dx$ $= \int \frac{1}{2\cos^2 x}\, dx\ dx$ $= \frac{1}{2}\int \sec^2 x\, dx$ $= \frac{1}{2}\tan x + c$	**02** ½ ½ 1
	e) Ans	Evaluate $\int x.e^x dx$ $\int x.e^x dx$ $= x\left(\int e^x dx\right) - \int\left(\int e^x dx \frac{d}{dx}(x)\right)dx$ $= xe^x - \int e^x.1\, dx$ $= xe^x - \int e^x\, dx$ $= xe^x - e^x + c$	**02** ½ ½ ½ ½
	f) Ans	Find area bounded by the curve $y = x^3$, $x-$axis and the ordinate $x=1$ to $x=3$ Area $A = \int_a^b y\, dx$ $= \int_1^3 x^3 dx$ $= \left[\frac{x^4}{4}\right]_1^3$	**02** ½ ½

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	f)	$=\left(\frac{3^4}{4}-\frac{1^4}{4}\right)$	½
		$=20$	½
	g)	If a fair coin is tossed three times, then find the probability of getting exactly two heads.	02
	Ans	$S=\{HHH,HHT,THH,HTH,HTT,THT,TTH,TTT\}$	
		$\therefore n(S)=8$	½
		$A=\{HHT,THH,HTH\}$	
		$\therefore n(A)=3$	½
		$\therefore P(A)=\frac{n(A)}{n(S)}=\frac{3}{8}=0.375$	1
2.		**Attempt any THREE of the following:**	12
	a)	Find $\frac{dy}{dx}$ if, $e^x+e^y=e^{x+y}$	04
	Ans	$e^x+e^y=e^{x+y}$	
		$\therefore e^x+e^y\frac{dy}{dx}=e^{x+y}\left(1+\frac{dy}{dx}\right)$	2
		$\therefore e^x+e^y\frac{dy}{dx}=e^{x+y}+e^{x+y}\frac{dy}{dx}$	
		$\therefore e^y\frac{dy}{dx}-e^{x+y}\frac{dy}{dx}=e^{x+y}-e^x$	
		$\therefore\left(e^y-e^{x+y}\right)\frac{dy}{dx}=e^{x+y}-e^x$	1
		$\therefore\frac{dy}{dx}=\frac{e^{x+y}-e^x}{e^y-e^{x+y}}$	1
		$\therefore\frac{dy}{dx}=\frac{e^x\left(e^y-1\right)}{e^y\left(1-e^x\right)}$	
	b)	If $x=a\cos^3\theta$, $y=b\sin^3\theta$. Find $\frac{dy}{dx}$ at $\theta=\frac{\pi}{3}$	04
	Ans	$x=a\cos^3\theta$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	$\therefore \frac{dx}{d\theta} = -3a\cos^2\theta\sin\theta$	1
		$y = b\sin^3\theta$	
		$\therefore \frac{dy}{d\theta} = 3b\sin^2\theta\cos\theta$	1
		$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{3b\sin^2\theta\cos\theta}{-3a\cos^2\theta\sin\theta}$	1
		$\therefore \frac{dy}{dx} = -\frac{b\sin\theta}{a\cos\theta}$	
		$\therefore \frac{dy}{dx} = -\frac{b}{a}\tan\theta$	½
		at $\theta = \frac{\pi}{3}$	
		$\therefore \frac{dy}{dx} = -\frac{b}{a}\tan\frac{\pi}{3}$	
		$\therefore \frac{dy}{dx} = -\frac{\sqrt{3}\text{ b}}{a}$	½
		--	
	c)	A telegraph wire hangs in the form of a curve $y = a.\log\left[\sec\left(\frac{x}{a}\right)\right]$ where a is constant. Show that, radius of curvature at any point is $a.\sec\left(\frac{x}{a}\right)$	**04**
	Ans	$y = a.\log\sec\left(\frac{x}{a}\right)$	
		$\therefore \frac{dy}{dx} = a\frac{1}{\sec\left(\frac{x}{a}\right)}\sec\left(\frac{x}{a}\right)\tan\left(\frac{x}{a}\right)\frac{1}{a}$	1
		$\therefore \frac{dy}{dx} = \tan\left(\frac{x}{a}\right)$	½
		$\therefore \frac{d^2y}{dx^2} = \sec^2\left(\frac{x}{a}\right)\frac{1}{a}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	c)	$\therefore$ Radius of curvature $\rho = \dfrac{\left[1+\left(\dfrac{dy}{dx}\right)^2\right]^{3/2}}{\dfrac{d^2y}{dx^2}}$	
		$= \dfrac{\left[1+\tan^2\left(\dfrac{x}{a}\right)\right]^{3/2}}{\sec^2\left(\dfrac{x}{a}\right)\dfrac{1}{a}}$	½
		$= \dfrac{a\left[\sec^2\left(\dfrac{x}{a}\right)\right]^{3/2}}{\sec^2\left(\dfrac{x}{a}\right)}$	½
		$= \dfrac{a\sec^3\left(\dfrac{x}{a}\right)}{\sec^2\left(\dfrac{x}{a}\right)}$	½
		$\therefore$ Radius of curvature $\rho = a\sec\left(\dfrac{x}{a}\right)$	½
		--	
	d)	A beam is supported at the two ends and is uniformly loaded. The bending moment M at a distance x from the end is given by $M = \dfrac{Wl}{2}\times x - \dfrac{W}{2}\times x^2$. Find the point at which M is maximum.	**04**
	Ans	$M = \dfrac{Wl}{2}\times x - \dfrac{W}{2}\times x^2$	
		$\therefore \dfrac{dM}{dx} = \dfrac{Wl}{2} - Wx$	1
		$\therefore \dfrac{d^2M}{dx^2} = -W$	1
		Consider $\dfrac{dM}{dx} = 0$	
		$\therefore \dfrac{Wl}{2} - Wx = 0$	
		$\therefore \dfrac{Wl}{2} = Wx$	
		$\therefore x = \dfrac{l}{2}$	1

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code:** 22206

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	d)	at $x=\frac{l}{2}$ $\therefore \frac{d^2M}{dx^2}=-W<0$ $\therefore$ the point $x=\frac{l}{2}$, M is maximum.	 1
		--	
3.		**Attempt any THREE of the following:**	**12**
	a)	Find the equation of tangent and normal to the curve $y=x^2$ at point $(-1,1)$	**04**
	Ans	$y=x^2$ $\therefore \frac{dy}{dx}=2x$ at $(-1,1)$ $\therefore \frac{dy}{dx}=2(-1)=-2$ $\therefore$ slope $m=-2$ Equation of tangent is $y-1=-2(x+1)$ $\therefore y-1=-2x-2$ $\therefore 2x+y+1=0$ $\therefore$ slope of normal $=\frac{-1}{m}=\frac{1}{2}$ Equation of normal is $y-1=\frac{1}{2}(x+1)$ $\therefore 2y-2=x+1$ $\therefore x-2y+3=0$	 1 ½ 1 ½ 1
		--	
	b)	Find $\frac{dy}{dx}$ if, $y=x^{\sin x}$	**04**
	Ans	$y=x^{\sin x}$ taking log on both sides, $\therefore \log y=\log x^{\sin x}$ $\therefore \log y=\sin x\log x$ diff.w.r.t.x	 1

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	b)	$\therefore \frac{1}{y}\frac{dy}{dx} = \sin x \frac{1}{x} + \log x \cos x$	2
		$\therefore \frac{dy}{dx} = y\left(\frac{\sin x}{x} + \cos x \log x\right)$	½
		$\therefore \frac{dy}{dx} = x^{\sin x}\left(\frac{\sin x}{x} + \cos x \log x\right)$	½
	c)	Find $\frac{dy}{dx}$ if, $y = \tan^{-1}\left(\frac{x}{1+12x^2}\right)$	**04**
	Ans	$y = \tan^{-1}\left(\frac{x}{1+12x^2}\right)$	
		$\therefore y = \tan^{-1}\left(\frac{4x-3x}{1+(4x)(3x)}\right)$	1
		$\therefore y = \tan^{-1}(4x) - \tan^{-1}(3x)$	1
		$\therefore \frac{dy}{dx} = \frac{1}{1+(4x)^2}\frac{d}{dx}(4x) - \frac{1}{1+(3x)^2}\frac{d}{dx}(3x)$	1
		$\therefore \frac{dy}{dx} = \frac{4}{1+16x^2} - \frac{3}{1+9x^2}$	1
	d)	Evaluate, $\int \frac{(\sin^{-1} x)^3}{\sqrt{1-x^2}}\, dx$	**04**
	Ans	$\int \frac{(\sin^{-1} x)^3}{\sqrt{1-x^2}}\, dx$	
		Put $\sin^{-1}x = t$	
		$\therefore \frac{1}{\sqrt{1-x^2}}\, dx = dt$	1
		$= \int t^3\, dt$	1
		$= \left(\frac{t^4}{4}\right) + c$	1
		$= \frac{1}{4}(\sin^{-1} x)^4 + c$	1

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.		**Attempt any THREE of the following:**	**12**
	a)	Evaluate $\int \frac{e^x(x+1)}{\cos^2(xe^x)}dx$	**04**
	Ans	$\int \frac{e^x(x+1)}{\cos^2(xe^x)}dx$	
		Put $xe^x = t$	1
		$\therefore e^x(x+1)dx = dt$	
		$= \int \frac{1}{\cos^2 t}dt$	½
		$= \int \sec^2 t\, dt$	1
		$= \tan t + c$	1
		$= \tan(xe^x) + c$	½
		--	
	b)	Evaluate, $\int \frac{dx}{5-4\cos x}$	**04**
	Ans	$\int \frac{dx}{5-4\cos x}$	
		Put $\tan\frac{x}{2} = t$, $dx = \frac{2dt}{1+t^2}$, $\cos x = \frac{1-t^2}{1+t^2}$	
		$I = \int \frac{\frac{2dt}{1+t^2}}{5-4\left(\frac{1-t^2}{1+t^2}\right)}$	1
		$= \int \frac{2dt}{5(1+t^2)-4(1-t^2)}$	
		$= 2\int \frac{dt}{5+5t^2-4+4t^2}$	
		$= 2\int \frac{dt}{9t^2+1}$	1
		$= 2\int \frac{dt}{(3t)^2+(1)^2}$ or $= \frac{2}{9}\int \frac{dt}{t^2+\left(\frac{1}{3}\right)^2}$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	$=2\frac{1}{1}\tan^{-1}\left(\frac{3t}{1}\right)\frac{1}{3}+c$ or $=\frac{2}{9}\frac{1}{\left(\frac{1}{3}\right)}\tan^{-1}\left(\frac{t}{\frac{1}{3}}\right)+c$	1
		$=\frac{2}{3}\tan^{-1}(3t)+c$	
		$=\frac{2}{3}\tan^{-1}\left(3\tan\frac{x}{2}\right)+c$	½
	c)	Evaluate $\int \tan^{-1} x\, dx$	**04**
	Ans	$\int \tan^{-1} x\, dx$	
		$=\int \tan^{-1} x.1\, dx$	
		$=\tan^{-1} x\int 1dx-\int\left(\left(\int 1dx\right)\frac{d}{dx}\left(\tan^{-1} x\right)dx+c\right.$	1
		$=x\tan^{-1} x-\int x\frac{1}{1+x^2}dx+c$	1
		$=x\tan^{-1} x-\frac{1}{2}\int\frac{2x}{1+x^2}dx+c$	1
		$=x\tan^{-1} x-\frac{1}{2}\log\left(1+x^2\right)+c$	1
	d)	Evaluate, $\int\frac{e^x.\, dx}{\left(e^x-1\right)\left(e^x+1\right)}$	**04**
	Ans	$\int\frac{e^x.\, dx}{\left(e^x-1\right)\left(e^x+1\right)}$	
		Put $e^x=t$	
		$\therefore e^x dx=dt$	1
		$\therefore\int\frac{1}{(t-1)(t+1)}dt$	
		$\frac{1}{(t-1)(t+1)}=\frac{A}{t-1}+\frac{B}{t+1}$	½
		$\therefore 1=A(t+1)+B(t-1)$	
		Put $t=1$	

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	d)	$\therefore A=\frac{1}{2}$	½
		Put $t=-1$	
		$\therefore B=-\frac{1}{2}$	½
		$\therefore \frac{1}{(t-1)(t+1)}=\frac{\frac{1}{2}}{t-1}-\frac{\frac{1}{2}}{t+1}$	
		$\therefore \int \frac{1}{(t-1)(t+1)}dt=\int\left(\frac{\frac{1}{2}}{t-1}-\frac{\frac{1}{2}}{t+1}\right)dt$	
		$=\frac{1}{2}\log(t-1)-\frac{1}{2}\log(t+1)+c$	1
		$=\frac{1}{2}\log(e^x-1)-\frac{1}{2}\log(e^x+1)+c$	½
		<u>OR</u>	
		$\int \frac{e^x.\,dx}{(e^x-1)(e^x+1)}$	
		Put $e^x=t$	1
		$\therefore e^x dx=dt$	
		$\therefore \int \frac{1}{(t-1)(t+1)}dt$	
		$=\int \frac{1}{t^2-1^2}dt$	1
		$=\frac{1}{2(1)}\log\left(\frac{t-1}{t+1}\right)+c$	1
		$=\frac{1}{2}\log\left(\frac{e^x-1}{e^x+1}\right)+c$	1
		--	
	e)	Evaluate, $\int_0^{\pi/2}\frac{dx}{1+\tan x}$	**04**
	Ans	$\int_0^{\pi/2}\frac{dx}{1+\tan x}$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)	$\therefore I=\int_0^{\pi/2}\frac{1}{1+\frac{\sin x}{\cos x}}\,dx$	
		$\therefore I=\int_0^{\pi/2}\frac{\cos x}{\cos x+\sin x}\,dx$ --------------------(1)	½
		$\therefore I=\int_0^{\pi/2}\frac{\cos\left(\pi/2-x\right)}{\cos\left(\pi/2-x\right)+\sin\left(\pi/2-x\right)}\,dx$	1
		$\therefore I=\int_0^{\pi/2}\frac{\sin x}{\sin x+\cos x}\,dx$ --------------------(2)	½
		add (1) and (2)	
		$\therefore I+I=\int_0^{\pi/2}\frac{\cos x}{\cos x+\sin x}\,dx+\int_0^{\pi/2}\frac{\sin x}{\sin x+\cos x}\,dx$	½
		$2I=\int_0^{\pi/2}\frac{\cos x+\sin x}{\cos x+\sin x}\,dx$	
		$2I=\int_0^{\pi/2}1\,dx$	½
		$2I=\left[x\right]_0^{\pi/2}$	½
		$2I=\frac{\pi}{2}-0$	
		$\therefore I=\frac{\pi}{4}$	½
		--	
5.		**Attempt any TWO of the following:**	**12**
	a)	Find area bounded by the curve $y^2=4x$ and $x^2=4y$	**06**
	Ans	$y^2=4x$ ---------(1)	
		$x^2=4y$	
		$\therefore y=\frac{x^2}{4}$	
		$\therefore \text{eq}^n.(1)\Rightarrow\left(\frac{x^2}{4}\right)^2=4x$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)	$\frac{x^4}{16}=4x$ $\therefore x^4=64x$ $\therefore x^4-64x=0$ $\therefore x\left(x^3-64\right)=0$ $\therefore x=0,4$	1
		Area $A=\int_a^b\left(y_1-y_2\right)dx$ $\therefore A=\int_0^4\left(2\sqrt{x}-\frac{x^2}{4}\right)dx$	1
		$\therefore A=\int_0^4\left(2x^{\frac{1}{2}}-\frac{x^2}{4}\right)dx$ $\therefore A=\left(\frac{2x^{\frac{3}{2}}}{\frac{3}{2}}-\frac{x^3}{12}\right)_0^4$	2
		$\therefore A=\left(\frac{2(4)^{\frac{3}{2}}}{\frac{3}{2}}-\frac{(4)^3}{12}\right)-0$	1
		$\therefore A=\frac{16}{3}$ or 5.333	1
		--	
	b)	**Attempt the following:**	**06**
	i)	Form a differential equation by eliminating arbitrary constant if $y=A.\cos\left(\log x\right)+B.\sin\left(\log x\right)$	**03**
	Ans	$y=A\cos\left(\log x\right)+B\sin\left(\log x\right)$ $\therefore \frac{dy}{dx}=-A\sin\left(\log x\right)\frac{1}{x}+B\cos\left(\log x\right)\frac{1}{x}$	1
		$\therefore x\frac{dy}{dx}=-A\sin\left(\log x\right)+B\cos\left(\log x\right)$ $\therefore x\frac{d^2y}{dx^2}+\frac{dy}{dx}(1)=-A\cos\left(\log x\right)\frac{1}{x}-B\sin\left(\log x\right)\frac{1}{x}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b) i)	$\therefore x^2\dfrac{d^2y}{dx^2}+x\dfrac{dy}{dx}=-A\cos(\log x)-B\sin(\log x)$	
		$\therefore x^2\dfrac{d^2y}{dx^2}+x\dfrac{dy}{dx}=-\left(A\cos(\log x)+B\sin(\log x)\right)$	½
		$\therefore x^2\dfrac{d^2y}{dx^2}+x\dfrac{dy}{dx}=-y$	
		$\therefore x^2\dfrac{d^2y}{dx^2}+x\dfrac{dy}{dx}+y=0$	½
		--	
	b)ii)	Solve, $x\left(1+y^2\right)dx+y\left(1+x^2\right)dy=0$	**03**
	Ans	$x\left(1+y^2\right)dx+y\left(1+x^2\right)dy=0$	
		$\therefore x\left(1+y^2\right)dx=-y\left(1+x^2\right)dy$	
		$\therefore \dfrac{x}{1+x^2}\ dx=\dfrac{-y}{1+y^2}\ dy$	1
		$\therefore \int\dfrac{x}{1+x^2}\ dx=-\int\dfrac{y}{1+y^2}\ dy$	½
		$\therefore \dfrac{1}{2}\int\dfrac{2x}{1+x^2}\ dx=-\dfrac{1}{2}\int\dfrac{2y}{1+y^2}\ dy$	½
		$\therefore \dfrac{1}{2}\log\left(1+x^2\right)=-\dfrac{1}{2}\log\left(1+y^2\right)+c$	1
		--	
	c)	A particle starting with velocity 6m/s has an acceleration $\left(1-t^2\right)$ m/s^2.when does it first come to rest? How far has it then travelled?	**06**
	Ans	Acceleration = $\dfrac{dv}{dt}=1-t^2$	
		$\therefore dv=\left(1-t^2\right)dt$	½
		$\therefore \int dv=\int\left(1-t^2\right)dt$	½
		$\therefore v=t-\dfrac{t^3}{3}+c$	½
		given $v=6$ and $t=0$	
		$\therefore c=6$	½
		$\therefore v=t-\dfrac{t^3}{3}+6$	

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code:** 22206

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	c)	The particle comes to rest when $v=0$	
		$\therefore t-\frac{t^3}{3}+6=0$	
		$\therefore t^3-3t-18=0$	1
		$\therefore t=3\text{sec}$	
		$\because v=\frac{dx}{dt}$	
		$\therefore \frac{dx}{dt}=t-\frac{t^3}{3}+6$	
		$\therefore dx=\left(t-\frac{t^3}{3}+6\right)dt$	
		$\therefore \int dx=\int\left(t-\frac{t^3}{3}+6\right)\,dt$	½
		$\therefore x=\frac{t^2}{2}-\frac{t^4}{12}+6t+c_1$	½
		$\therefore$ initially $x=0$, $t=0$	
		$c_1=0$	½
		$\therefore x=\frac{t^2}{2}-\frac{t^4}{12}+6t$	½
		put $t=3$	
		$\therefore x=\frac{(3)^2}{2}-\frac{(3)^4}{12}+6(3)$	
		$\therefore x=15.75\ m$	1
		--	
6.		**Attempt any TWO of the following:**	**12**
	a) i)	An unbiased coin is tossed 5 times. Find probability of getting three heads.	**03**
	Ans	$n=5\ ,\ p=\frac{1}{2}\ ,\ q=\frac{1}{2}\ ,\ r=3$	
		$\therefore P(r)={}^nC_r p^r q^{n-r}$	
		$\therefore P(3)={}^5C_3\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3}$	2
		$\therefore P(3)=\frac{10}{32}$ or 0.1562	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)ii)	Fit a Poisson's distribution for the following observations	**03**
		x_i: 20, 30, 40, 50, 60, 70; f_i: 8, 12, 30, 10, 6, 4	
	Ans	$\text{Mean} = m = \frac{\sum f_i x_i}{\sum f_i}$	
		$\therefore m = \frac{20(8)+30(12)+40(30)+50(10)+60(6)+70(4)}{8+12+30+10+6+4}$	
		$\therefore m = \frac{2860}{70} = 40.85$	2
		Poisson distribution is ,	
		$P(x=r) = \frac{e^{-m} m^r}{r!}$	
		$\therefore P(r) = \frac{e^{-40.85} (40.85)^r}{r!}$	1
	b)	If 2% of the electric bulbs manufactured by a company are defective. Find the probability that in sample of 100 bulbs.	**06**
		(i) 3 are defective	
		(ii) At least two are defective.	
	Ans	$p = 2\% = 0.02$, $n = 100$	
		$\therefore$ mean $m = np$	
		$\therefore m = 100 \times 0.02 = 2$	1
		Poisson's distribution is,	
		$P(r) = \frac{e^{-m} \cdot m^r}{r!}$	
		(i) 3 bulbs are defective $\therefore r = 3$	
		$\therefore P(3) = \frac{e^{-2} (2)^3}{3!}$	1
		$\therefore P(3) = 0.1804$	1
		(ii) At least two are defective	
		$\therefore P(\text{at least two are defective}) = 1 - [P(0) + P(1)]$	

The table of observations:

x_i	20	30	40	50	60	70
f_i	8	12	30	10	6	4

WINTER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	b)	$\therefore P(\text{at least two are defective}) = 1 - \left[\dfrac{e^{-2}(2)^0}{0!} + \dfrac{e^{-2}(2)^1}{1!}\right]$	2
		$= 0.5939$	1
	c)	In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution is to be normal,	**06**
		(i) How many students score between 12 and 15	
		(ii) How many students score above 18	
		Given	
		Frequency 0 to 0.8 = 0.2881	
		Frequency 0 to 0.4 = 0.1554	
		Frequency 0 to 1.6 = 0.4452	
	Ans	Given $\bar{x} = 14$ $\sigma = 2.5$ $N = 1000$	
		$i)\ z = \dfrac{x - \bar{x}}{\sigma} = \dfrac{12-14}{2.5} = -0.8$	1
		$z = \dfrac{x - \bar{x}}{\sigma} = \dfrac{15-14}{2.5} = 0.4$	1
		$\therefore p(\text{score between 12 and 15}) = A(-0.8) + A(0.4)$	
		$= 0.2881 + 0.1554$	
		$= 0.4435$	1
		$\therefore \text{No.of students} = N \cdot p = 1000 \times 0.4435$	
		$= 443.5$ *i.e.*, 444	½
		$ii)\ z = \dfrac{x - \bar{x}}{\sigma} = \dfrac{18-14}{2.5} = 1.6$	1
		$\therefore p(\text{ above 18}) = A(\text{greater than 1.6})$	
		$= 0.5 - A(1.6)$	
		$= 0.5 - 0.4452 = 0.0548$	1
		$\therefore \text{No.of students} = N \cdot p$	
		$= 1000 \times 0.0548 = 54.8$ *i.e.*, 55	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
		Important Note *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.* -- --	

22206

21819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. **Attempt any <u>FIVE</u> of the following:** **10**

a) State whether the function is even or odd,

If $f(x) = 3x^4 - 2x^2 + \cos x$.

b) If $f(x) = x^2 + 6x + 10$ find $f(2) + f(-2)$

c) Find $\frac{dy}{dx}$ if $y = \log x + \log_5 x + \log_5 5$

d) Evaluate $\int \sin^2 x \, dx$

e) Evaluate $\int (x^a + a^x + a^a) dx$

f) Find the area under the curve $y = e^x$ bet^n the ordinates $x = 0$ and $x = 1$.

g) An unbiased coin is tossed 5 times. Find the probability of getting three heads.

Marks

2. Attempt any THREE of the following: **12**

a) If $x^2 + y^2 = 4xy$ find $\frac{dy}{dx}$ at $(2, -1)$

b) If $x = a(1 + \cos\theta)$ and $y = a(1 - \cos\theta)$ find $\frac{dy}{dx}$

c) A metal wire of 40 cm long is bent to form a rectangle. Find its dimensions when its area is maximum.

d) A telegraph wire hangs in the form of a curve $y = a.\log \sec\left(\frac{x}{a}\right)$ where 'a' is constant. Show that the curvature at any point is $\frac{1}{a} \cdot \cos\left(\frac{x}{a}\right)$.

3. Attempt any THREE of the following: **12**

a) Find the equation of tangent and normal to the curve $y = x(2 - x)$ at point $(2, 0)$

b) Find $\frac{dy}{dx}$ if $y = a^x + x^a + a^a + x^x$

c) If $y = \tan^{-1}\left(\frac{5x}{1 - 6x^2}\right)$ find $\frac{dy}{dx}$

d) Evaluate $\int \frac{(x - 1)e^x}{x^2 \cdot \sin^2\left(\frac{e^x}{x}\right)} dx$

4. Attempt any THREE of the following: **12**

a) Evaluate $\int \frac{1}{x + \sqrt{x}} dx$

b) Evaluate $\int \frac{dx}{5 + 4\cos x}$

c) Evaluate $\int x \cdot \tan^{-1} x \, dx$

d) Evaluate $\int \frac{\sec^2 x}{(1 + \tan x)(2 - \tan x)} dx$

e) Evaluate $\int_0^5 \frac{\sqrt{9 - x}}{\sqrt{9 - x} + \sqrt{x + 4}} dx$

Marks

5. Attempt any TWO of the following: 12

a) Find the area bounded by curves $y^2 = x$ and $x^2 = y$.

b) Attempt the following

i) Solve the differential equation

$$\frac{dy}{dx} + y \tan x = \cos^2 x$$

ii) Find order and degree of the differential equation.

$$\frac{d^2 y}{dx^2} = \sqrt[4]{y + \left(\frac{dy}{dx}\right)^2}$$

c) Acceleration of a moving particle at the end of 't' seconds from the start of its motion is (5 – 2t) m/s^2. Find it's velocity at the end of 3 seconds and distance travelled by it during that period, if its initial velocity is 4 m/s.

6. Attempt any TWO of the following: 12

a) Attempt the following

i) The probability that a man aged 65 will live to 75 is 0.65. What is the probability that out of 10 men which are now 65, 7 will live to 75.

ii) The probability that a bomb dropped from a Plane will strike the target is $\frac{1}{5}$. If six bombs are dropped, find the probability that exactly two will strike the target.

b) If 2% of the electric bulbs manufactured by company are defective, find the probability that in a sample of 100 bulbs.

(i) 3 bulbs are defective,

(ii) At the most two bulbs will be defective. ($e^{-2} = 0.1353$)

c) In a test on 2000 electric bulbs, it was found that the life of particular make was normally distributed with average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for:

(i) Between 1920 hours and 2160 hours.

(ii) More than 2150 hours.

Given that: A (2) = 0.4772

A (1.83) = 0.4664

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

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 FIVE of the following:**	**10**
	a)	State whether the function is even or odd,	**02**
		If $f\left(x\right)=3x^4-2x^2+\cos x$	
	Ans	$f\left(x\right)=3x^4-2x^2+\cos x$	
		$\therefore f\left(-x\right)=3\left(-x\right)^4-2\left(-x\right)^2+\cos\left(-x\right)$	½
		$\therefore f\left(-x\right)=3x^4-2x^2+\cos x$	½
		$\therefore f\left(-x\right)=f\left(x\right)$	½
		$\therefore$ function is an even function	½
		--	
	b)	If $f\left(x\right)=x^2+6x+10$ find $f\left(2\right)+f\left(-2\right)$	**02**
	Ans	$f\left(2\right)=\left(2\right)^2+6\left(2\right)+10=26$	½
		$f\left(-2\right)=\left(-2\right)^2+6\left(-2\right)+10=2$	½
		$\therefore f\left(2\right)+f\left(-2\right)=26+2$	
		$=28$	1
		--	
	c)	Find $\dfrac{dy}{dx}$ if $y=\log x+\log_5 x+\log_5 5$	**02**
	Ans	$y=\log x+\log_5 x+\log_5 5$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	c)	$\therefore\ y=\log x+\frac{\log x}{\log 5}+\log_5 5$ $\therefore \frac{dy}{dx}=\frac{1}{x}+\frac{1}{x\log 5}+0$ $\therefore \frac{dy}{dx}=\frac{1}{x}+\frac{1}{x\log 5}$	2
	d)	Evaluate $\int \sin^2 x\ dx$	**02**
	Ans	$\int \sin^2 x\ dx$ $=\frac{1}{2}\int 2\sin^2 x\ dx$ $=\frac{1}{2}\int(1-\cos 2x)\ dx$ $=\frac{1}{2}\left(x-\frac{\sin 2x}{2}\right)+c$	1 1
	e)	Evaluate $\int\left(x^a+a^x+a^a\right)\ dx$	**02**
	Ans	$\int\left(x^a+a^x+a^a\right)\ dx$ $=\frac{x^{a+1}}{a+1}+\frac{a^x}{\log a}+a^a x+c$	2
	f)	Find the area under the curve $y=e^x$ bet^n the ordinates $x=0$ and $x=1$	**02**
	Ans	Area $A=\int_a^b y\ dx$ $=\int_0^1 e^x dx$ $=\left[e^x\right]_0^1$ $=e^1-e^0$ $=e-1$	½ ½ ½ ½

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	g)	An unbaised coin is tossed 5 times. Find the probability of getting three heads.	
	Ans	$n=5\ ,\ p=\frac{1}{2}\ ,\ q=\frac{1}{2}\ ,\ r=3$	
		$\therefore P(r)={}^{n}C_{r}p^{r}q^{n-r}$	
		$\therefore P(3)={}^{5}C_{3}\left(\frac{1}{2}\right)^{3}\left(\frac{1}{2}\right)^{5-3}$	1
		$\therefore P(3)=\frac{5}{16}$ or 0.3125	1
		--	
2.		**Attempt any <u>THREE</u> of the following:**	**12**
	a)	If $x^2+y^2=4xy$ find $\frac{dy}{dx}$ at $(2,-1)$	**04**
	Ans	$x^2+y^2=4xy$	
		$\therefore 2x+2y\frac{dy}{dx}=4\left(x\frac{dy}{dx}+y.1\right)$	2
		$\therefore 2x+2y\frac{dy}{dx}=4x\frac{dy}{dx}+4y$	
		$\therefore (2y-4x)\frac{dy}{dx}=4y-2x$	
		$\therefore \frac{dy}{dx}=\frac{4y-2x}{2y-4x}$	1
		$\therefore \frac{dy}{dx}=\frac{2y-x}{y-2x}$	
		at $(2,-1)$	
		$\therefore \frac{dy}{dx}=\frac{2(-1)-2}{-1-2(2)}$	
		$\therefore \frac{dy}{dx}=\frac{4}{5}$	1
		--	
	b)	If $x=a(1+\cos\theta)\ ,\ y=a(1-\cos\theta)$ find $\frac{dy}{dx}$	**04**
	Ans	$x=a(1+\cos\theta)\quad ,\quad y=a(1-\cos\theta)$	

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	$\therefore \frac{dx}{d\theta}=-a\sin\theta$, $\frac{dy}{d\theta}=a\sin\theta$	1+1
	Ans	$\frac{dy}{dx}=\frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}=\frac{a\sin\theta}{-a\sin\theta}$	1
		$\therefore \frac{dy}{dx}=-1$	1
	c)	A metal wire of 40 cm long is bent to form a rectangle.Find its dimensions when its area is maximum.	**04**
	Ans	$2x+2y=40$	
		$\therefore x+y=20$	
		$\therefore y=20-x$	
		Area $A=xy$	
		$\therefore A=x(20-x)$	1
		$\therefore A=20x-x^2$	
		$\therefore \frac{dA}{dx}=20-2x$	1
		$\therefore \frac{d^2A}{dx^2}=-2$	½
		Consider $\frac{dA}{dx}=0$	
		$20-2x=0$	
		$\therefore x=10$	
		at $x=10$ $\therefore \frac{d^2A}{dx^2}=-2<0$	1
		$\therefore$ Area is maximum at $x=10$	
		$\therefore x=10, y=10$	½
	d)	A telegraph wire hangs in the form of a curve $y=a.\log\sec\left(\frac{x}{a}\right)$ where 'a' is constant. Show that the curvature at any point is $\frac{1}{a}.\cos\left(\frac{x}{a}\right)$.	**04**

SUMMER–2019 EXAMINATION

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	d)	$y = a.\log\sec\left(\frac{x}{a}\right)$	
		$\therefore \frac{dy}{dx} = a\frac{1}{\sec\left(\frac{x}{a}\right)}\sec\left(\frac{x}{a}\right)\tan\left(\frac{x}{a}\right)\frac{1}{a}$	1
		$\therefore \frac{dy}{dx} = \tan\left(\frac{x}{a}\right)$	
		$\therefore \frac{d^2y}{dx^2} = \sec^2\left(\frac{x}{a}\right)\frac{1}{a}$	1
		$\therefore$ Radius of curvature $\rho = \frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\frac{d^2y}{dx^2}}$	
		$= \frac{\left[1+\tan^2\left(\frac{x}{a}\right)\right]^{3/2}}{\sec^2\left(\frac{x}{a}\right)\frac{1}{a}}$	½
		$= \frac{a\left[\sec^2\left(\frac{x}{a}\right)\right]^{3/2}}{\sec^2\left(\frac{x}{a}\right)}$	
		$= \frac{a\sec^3\left(\frac{x}{a}\right)}{\sec^2\left(\frac{x}{a}\right)}$	
		$\therefore$ Radius of curvature $\rho = a\sec\left(\frac{x}{a}\right)$	1
		$\therefore$ curvature $= \frac{1}{\rho} = \frac{1}{a}\cos\left(\frac{x}{a}\right)$	½
3.		**Attempt any <u>THREE</u> of the following:**	**12**
	a)	Find the equation of tangent and normal to the curve $y = x(2-x)$ at point $(2,0)$	**04**

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	a) Ans	$y=x(2-x)$ $\therefore y=2x-x^2$ $\therefore \frac{dy}{dx}=2-2x$ at $(2,0)$ $\therefore \frac{dy}{dx}=2-2(2)$ $\therefore \frac{dy}{dx}=-2$ $\therefore$ slope of tangent , $m=-2$ Equation of tangent at $(2,0)$ is $y-0=-2(x-2)$ $\therefore y=-2x+4$ $\therefore 2x+y-4=0$ $\therefore$ slope of normal , $m'=\frac{-1}{m}=\frac{1}{2}$ Equation of normal at $(2,0)$ is $y-0=\frac{1}{2}(x-2)$ $\therefore 2y=x-2$ $\therefore x-2y-2=0$ --	½ ½ ½ ½ ½ ½ ½ ½ **04**
	b) Ans	Find $\frac{dy}{dx}$ if $y=a^x+x^a+a^a+x^x$ $y=a^x+x^a+a^a+x^x$ Let $u=x^x$ Taking log on both sides, $\therefore \log u=\log x^x$ $\therefore \log u=x\log x$ $\therefore \frac{1}{u}\frac{du}{dx}=x\frac{1}{x}+\log x.1$ $\therefore \frac{1}{u}\frac{du}{dx}=1+\log x$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	b)	$\therefore \frac{du}{dx} = u(1+\log x)$	
		$\therefore \frac{du}{dx} = x^x(1+\log x)$	1
		$y = a^x + x^a + a^a + x^x$	
		$\therefore \frac{dy}{dx} = a^x \log a + ax^{a-1} + 0 + x^x(1+\log x)$	2
		$\therefore \frac{dy}{dx} = a^x \log a + ax^{a-1} + x^x(1+\log x)$	
		--	
	c)	If $y = \tan^{-1}\left(\frac{5x}{1-6x^2}\right)$ find $\frac{dy}{dx}$	**04**
	Ans	$y = \tan^{-1}\left(\frac{5x}{1-6x^2}\right)$	
		$\therefore y = \tan^{-1}\left(\frac{3x+2x}{1-(3x)(2x)}\right)$	1
		$\therefore y = \tan^{-1}(3x) + \tan^{-1}(2x)$	1
		$\therefore \frac{dy}{dx} = \frac{1}{1+(3x)^2}(3) + \frac{1}{1+(2x)^2}(2)$	2
		$\therefore \frac{dy}{dx} = \frac{3}{1+9x^2} + \frac{2}{1+4x^2}$	
		--	
	d)	Evaluate $\int \frac{(x-1)e^x}{x^2.\sin^2\left(\frac{e^x}{x}\right)}\,dx$	**04**
	Ans	$\int \frac{(x-1)e^x}{x^2.\sin^2\left(\frac{e^x}{x}\right)}\,dx$	
		Put $\frac{e^x}{x} = t$	
		$\therefore \frac{xe^x - e^x 1}{x^2}\,dx = dt$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	$\therefore \frac{e^x(x-1)}{x^2}\,dx = dt$	
		$\int \frac{1}{\sin^2 t}\,dt$	
		$= \int \operatorname{cosec}^2 t\,dt$	1
		$= -\cot t + c$	1
		$= -\cot\left(\frac{e^x}{x}\right) + c$	1
4.		**Attempt any <u>THREE</u> of the following:**	**12**
	a)	Evaluate $\int \frac{1}{x+\sqrt{x}}\,dx$	**04**
	Ans	$\int \frac{1}{x+\sqrt{x}}\,dx$	
		$= \int \frac{1}{\sqrt{x}\left(\sqrt{x}+1\right)}\,dx$	
		Put $\sqrt{x}+1 = t$	
		$\therefore \frac{1}{2\sqrt{x}}\,dx = dt$	1
		$\therefore \frac{1}{\sqrt{x}}\,dx = 2dt$	
		$= 2\int \frac{1}{t}\,dt$	1
		$= 2\log t + c$	1
		$= 2\log\left(\sqrt{x}+1\right) + c$	1
	b)	Evaluate $\int \frac{dx}{5+4\cos x}$	**04**
	Ans	$\int \frac{dx}{5+4\cos x}$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	b)	Put $\tan\frac{x}{2}=t$, $dx=\frac{2dt}{1+t^2}$, $\cos x=\frac{1-t^2}{1+t^2}$	1
		$\int\frac{\frac{2dt}{1+t^2}}{5+4\left(\frac{1-t^2}{1+t^2}\right)}$	
		$=\int\frac{2dt}{5(1+t^2)+4(1-t^2)}$	
		$=2\int\frac{dt}{5+5t^2+4-4t^2}$	
		$=2\int\frac{dt}{t^2+9}$	1
		$=2\int\frac{dt}{t^2+3^2}$	
		$=2\frac{1}{3}\tan^{-1}\frac{t}{3}+c$	1
		$=\frac{2}{3}\tan^{-1}\left(\frac{\tan\frac{x}{2}}{3}\right)+c$	1
		--	
	c)	Evaluate $\int x\cdot\tan^{-1}x\,dx$	**04**
	Ans	$\int x\cdot\tan^{-1}x\,dx$	
		$=\tan^{-1}x\int xdx-\int\left(\int xdx\right)\frac{d}{dx}\left(\tan^{-1}x\right)dx$	1
		$=\frac{x^2}{2}\tan^{-1}x-\int\frac{x^2}{2}\frac{1}{x^2+1}dx$	1
		$=\frac{x^2}{2}\tan^{-1}x-\frac{1}{2}\int\frac{x^2}{x^2+1}dx$	
		$=\frac{x^2}{2}\tan^{-1}x-\frac{1}{2}\int\frac{(x^2+1)-1}{x^2+1}dx$	1
		$=\frac{x^2}{2}\tan^{-1}x-\frac{1}{2}\int\left(1-\frac{1}{x^2+1}\right)dx$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	c)	$=\frac{x^2}{2}\tan^{-1}x-\frac{1}{2}\left(x-\tan^{-1}x\right)+c$	1
		--	
	d)	Evaluate $\int\frac{\sec^2 x}{(1+\tan x)(2-\tan x)}dx$	**04**
	Ans	$\int\frac{\sec^2 x}{(1+\tan x)(2-\tan x)}dx$	
		Put $\tan x=t$	1
		$\therefore \sec^2 x\,dx=dt$	
		$\therefore \int\frac{1}{(1+t)(2-t)}dt$	
		$\frac{1}{(1+t)(2-t)}=\frac{A}{1+t}+\frac{B}{2-t}$	½
		$\therefore 1=A(2-t)+B(1+t)$	½
		$\therefore$ Put $t=-1$, $A=\frac{1}{3}$	½
		Put $t=2$, $B=\frac{1}{3}$	
		$\therefore \frac{1}{(1+t)(2-t)}=\frac{1/3}{1+t}+\frac{1/3}{2-t}$	
		$\therefore \int\frac{1}{(1+t)(2-t)}dt=\int\left(\frac{1/3}{1+t}+\frac{1/3}{2-t}\right)dt$	
		$=\frac{1}{3}\log(1+t)+\frac{1}{3}\frac{\log(2-t)}{(-1)}+c$	1
		$=\frac{1}{3}\log(1+\tan x)-\frac{1}{3}\log(2-\tan x)+c$	½
		--	
	e)	Evaluate $\int_0^5\frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}}\,dx$	**04**

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e) Ans	Let $I=\int_0^5 \frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}}\,dx$ --------------------(1)	
		$I=\int_0^5 \frac{\sqrt{9-(5-x)}}{\sqrt{9-(5-x)}+\sqrt{5-x+4}}\,dx$	1
		$\therefore I=\int_0^5 \frac{\sqrt{9-5+x}}{\sqrt{\sqrt{9-5+x}}+\sqrt{9-x}}\,dx$	
		$\therefore I=\int_0^5 \frac{\sqrt{4+x}}{\sqrt{\sqrt{4+x}}+\sqrt{9-x}}\,dx$ --------------------(2)	
		add (1) and (2)	
		$\therefore I+I=\int_0^5 \frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}}\,dx+\int_0^5 \frac{\sqrt{4+x}}{\sqrt{\sqrt{4+x}}+\sqrt{9-x}}\,dx$	1
		$\therefore 2I=\int_0^5 \frac{\sqrt{9-x}+\sqrt{4+x}}{\sqrt{9-x}+\sqrt{x+4}}\,dx$	
		$\therefore 2I=\int_0^5 1\,dx$	½
		$\therefore 2I=[x]_0^5$	1
		$\therefore 2I=5-0$	
		$\therefore I=\frac{5}{2}$	½
		--	
5.		**Attempt any TWO of the following:**	**12**
	a)	Find the area bounded by curves $y^2=x$ and $x^2=y$	
	Ans	$y^2=x$ ---------(1)	
		$x^2=y$	
		$\therefore \text{eq}^n.(1)\Rightarrow x^4=x$	
		$\therefore x^4-x=0$	
		$\therefore x^3(x-1)=0$	
		$\therefore x=0,1$	1
		Area $A=\int_a^b (y_1-y_2)\,dx$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a)	$\therefore A=\int_0^1\left(\sqrt{x}-x^2\right)dx$	1
		$\therefore A=\left(\frac{x^{\frac{3}{2}}}{\frac{3}{2}}-\frac{x^3}{3}\right)_0^1$	2
		$\therefore A=\left(\frac{(1)^{\frac{3}{2}}}{\frac{3}{2}}-\frac{(1)^3}{3}\right)-0$	1
		$\therefore A=\left(\frac{2}{3}-\frac{1}{3}\right)$	
		$\therefore A=\frac{1}{3}$ or 0.333	1
		---	
	b)	Attempt the following	**06**
	i)	Solve the differential equation $\frac{dy}{dx}+y\tan x=\cos^2 x$	**03**
	Ans	$\frac{dy}{dx}+y\tan x=\cos^2 x$	
		$\therefore$ Comparing with $\frac{dy}{dx}+Py=Q$	
		$P=\tan x$, $Q=\cos^2 x$	
		Integrating factor $IF=e^{\int\tan x dx}=e^{\log(\sec x)}=\sec x$	1
		Solution is,	
		$y.IF=\int Q.IFdx+c$	1
		$\therefore y\sec x=\int\cos^2 x\sec x\,dx$	
		$\therefore y\sec x=\int\cos^2 x\frac{1}{\cos x}\,dx$	
		$\therefore y\sec x=\int\cos x\,dx$	
		$\therefore y\sec x=\sin x+c$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b) ii)	Find order and degree of the differential equation $\frac{d^2y}{dx^2}=\sqrt[4]{y+\left(\frac{dy}{dx}\right)^2}$	
	Ans	$\frac{d^2y}{dx^2}=\sqrt[4]{y+\left(\frac{dy}{dx}\right)^2}$ $\left(\frac{d^2y}{dx^2}\right)^4=y+\left(\frac{dy}{dx}\right)^2$ $\therefore$ Order $=2$ Degree $=4$	 1 1 1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	c)	Acceleration of a moving particle at the end of $'t'$ seconds from the start of its motion is $(5-2t)\ m/s^2$. Find it's velocity at the end of 3 seconds and distance travelled by it during that period, if its initial velocity is 4 m/s.	**06**
	Ans	Acceleration $=5-2t$	
		$i.e.\ a=\dfrac{dv}{dt}=5-2t$	½
		$\therefore \int dv=\int(5-2t)\ dt$	1
		$\therefore v=5t-t^2+c_1$	½
		when $t=0$, $v=4$ $\quad\therefore c_1=4$	
		$\therefore v=5t-t^2+4$	
		when $t=3$	
		$\therefore v=5(3)-(3)^2+4=10\ m/s$	1
		$\because v=\dfrac{dx}{dt}=5t-t^2+4$	
		$\therefore dx=(5t-t^2+4)dt$	½
		$\therefore \int dx=\int(5t-t^2+4)dt$	
		$\therefore x=\dfrac{5t^2}{2}-\dfrac{t^3}{3}+4t+c_2$	1
		at $t=0$, $x=0$ $\quad\therefore c_2=0$	½
		$\therefore x=\dfrac{5t^2}{2}-\dfrac{t^3}{3}+4t$	
		at $t=3$	
		$\therefore x=\dfrac{5(3)^2}{2}-\dfrac{(3)^3}{3}+4(3)=25.5\ m$	1
		--	
6.		**Attempt any <u>TWO</u> of the following:**	
	a)	Attempt the following	
	i)	The probability that a man aged 65 will live to 75 is 0.65. What is the probability that out of 10 men which are now 65, 7 will live to 75.	
	Ans	Given $p=0.65$, $q=1-0.65=0.35$, $n=10$, $r=7$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	a) i)	$\because p(r)={}^{n}C_{r}(p)^{r}(q)^{n-r}$	
		$\therefore p(7)={}^{10}C_{7}(0.65)^{7}(0.35)^{10-7}$	2
		$\therefore p(7)=0.2522$	1
		--	
	a) ii)	The probability that a bomb dropped from a Plane will strike the target is $\frac{1}{5}$.If six bombs are dropped, find the probability that exactly two will strike the target.	**03**
	Ans	Given	
		$p=\frac{1}{5}=0.2$, $q=1-0.2=0.8$	
		$n=6$, $r=2$	
		$\because p(r)={}^{n}C_{r}(p)^{r}(q)^{n-r}$	
		$\therefore p(2)={}^{6}C_{2}(0.2)^{2}(0.8)^{6-2}$	2
		$\therefore p(2)=0.2458$	1
		--	
	b)	If 2% of the electric bulbs manufactured by company are defective, find the probability that in a sample of 100 bulbs. (i) 3 bulbs are defective, (ii) At the most two bulbs will be defective.$\left(e^{-2}=0.1353\right)$	**06**
	Ans	$p=2\%=0.02$, $n=100$	
		$\therefore$ mean $m=np$	
		$\therefore m=100\times0.02=2$	1
		Poisson's distribution is,	
		$P(r)=\frac{e^{-m}\cdot m^{r}}{r!}$	
		(i) 3 bulbs are defective $\therefore r=3$	
		$\therefore P(3)=\frac{e^{-2}(2)^{3}}{3!}$	1
		$\therefore P(3)=0.1804$	1
		(ii) At the most two bulbs will be defective $\therefore r=0,1,2$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	b)	$\therefore P(r)=P(0)+P(1)+P(2)$	
		$\therefore P(0)=\dfrac{e^{-2}(2)^0}{0!}+\dfrac{e^{-2}(2)^1}{1!}+\dfrac{e^{-2}(2)^2}{2!}$	2
		$=0.6767$	1
		--	
	c)	In a test on 2000 electric bulbs, it was found that the life of particular make was normally distributed with average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for:	**06**
		(i) between 1920 hours and 2160 hours.	
		(ii) more than 2150 hours.	
		Given that: $\text{A}(2)=0.4772$	
		$\text{A}(1.83)=0.4664$	
	Ans	Given $\bar{x}=2040$ $\sigma=60$ $N=2000$	
		$i)$ For $x=1920$	
		$z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{1920-2040}{60}=-2$	½
		For $x=2160$	
		$z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{2160-2040}{60}=2$	½
		$\therefore p(\text{between 1920 and 2160})=A(\text{ between }-2\text{ and }2)$	
		$=A(-2)+A(2)$	½
		$=0.4772+0.4772$	
		$=0.9544$	1
		$\therefore \text{No.of } bulbs=N\cdot p$	
		$=2000\times 0.9544=1908.8\approx 1909$	½
		$ii)$ For $x=2150$	
		$z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{2150-2040}{60}=1.83$	½
		$\therefore p(\text{more than 2150})=A(\text{more than 1.83})$	
		$=0.5-A(1.83)$	
		$=0.5-0.4664$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	c)	$\therefore p(\text{more than } 2150) = 0.0336$ $\therefore \text{No. of students} = N \cdot p = 2000 \times 0.0336$ $= 67.2 \approx 67$	1 ½

Important Note

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.

22206

11819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Test whether the function is even or odd if $f(x) = x^3 + 4x + \sin x$.

(b) If $f(x) = x^2 + 5x + 1$ then find $f(0) + f(1)$.

(c) Find dy/dx if $y = x^n + a^x + e^x + \sin x$.

(d) Evaluate $\int x\, e^x\, dx$.

(e) Evaluate $\int \tan^2 x\, dx$.

(f) Find the area bounded by the curve $y= 2x$, x-axis and the co-ordinates $x = 1$, $x = 3$.

(g) If the coin is tossed 5 times, find the probability of getting head.

2. Attempt any THREE of the following : 12

(a) Find $\frac{dy}{dx}$ if x.log y + y.log x = 0.

(b) If x = a.sec t, y = b.tan t, find $\frac{dy}{dx}$ at t = π/2.

(c) The rate of working of an engine is given by the expression $10\,V + \frac{4000}{V}$, where 'V' is the speed of the engine. Find the speed at which the rate of working is the least.

(d) A telegraph wire hangs in the form of the curve y = a.log [sec (x/a)] where 'a' is constant. Show that the radius of curvature at any point is a.sec(x/a).

3. Attempt any THREE of the following : 12

(a) Find the equation of tangent and normal to the curve $4x^2 + 9y^2 = 40$ at (1, 2).

(b) If $\log\left(\sqrt{x^2 + y^2}\right) = \tan^{-1}\left(\frac{y}{x}\right)$, find $\frac{dy}{dx}$.

(c) If $y = \log(x^2 e^x)$, find $\frac{dy}{dx}$.

(d) Evaluate $\int \frac{e^{m \sin^{-1} x}}{\sqrt{1 - x^2}}\, dx$.

4. Attempt any THREE of the following : 12

(a) Evaluate $\int \frac{1}{\sqrt{x^2 + 4x + 13}}\, dx$.

(b) Evaluate $\int \frac{1}{5 + 4 \cos x}\, dx$

(c) Evaluate $\int x.\log(1 + x)\, dx$

(d) Evaluate $\int \frac{\sec^2 x}{(1 + \tan x)(2 + \tan x)} dx$

(e) Evaluate $\int_0^4 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5} + \sqrt[3]{9-x}} dx.$

5. Attempt any TWO of the following : 12

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

(b) Attempting the following :

(i) Form the differential equation by eliminating the arbitrary constants if $y = A \cos 3x + B \sin 3x$.

(ii) Solve $e^{x+y}dx + e^{2y-x}dy = 0$.

(c) A body moves according to the law of motion is given by $\frac{d^2x}{dt^2} = 3t^2$. Find its velocity at t = 1 & v = 2.

6. Attempt any TWO of the following : 12

(a) Attempt the following :

(i) On an average 2% of the population in an area suffer from T. B. What is the probability that out of 5 persons chosen at random from this area, atleast two suffer from T. B. ?

(ii) 10% of the component manufactured by company are defective. If twelve components selected at random, find the probability that atleast two will be defective.

(b) The number of road accidents met with by taxi drivers follow Poisson distribution with mean 2 out of 5000 taxi in the city, find the number of drivers.

(i) Who does not meet an accident.

(ii) Who met with an accidents more than 3 items. (Given $e^{-2} = 0.1353$)

(c) Weight of 4000 students are found to be normally distributed with mean 50 kgs and standard deviation 5 kgs. Find the number of students with weights

(i) less than 45 kgs

(ii) between 45 and 60 kgs

(Given : For a standard normal variate z area under the curve between $z = 0$ and $z = 1$ is 0.3413 and that between $z = 0$ and $z = 2$ is 0.4772)

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

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 answer 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.	Answer	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	Test whether the function is even or odd if $f(x)=x^3+4x+\sin x$.	**02**
	Ans	$f(x)=x^3+4x+\sin x$	½
		$\therefore f(-x)=(-x)^3+4(-x)+\sin(-x)$	½
		$=-x^3-4x-\sin x$	½
		$=-(x^3+4x+\sin x)$	
		$=-f(x)$	½
		$\therefore$ function is odd.	
	b)	If $f(x)=x^2+5x+1$ then find $f(0)+f(1)$	**02**
	Ans	$f(x)=x^2+5x+1$	
		$\therefore f(0)=(0)^2+5(0)+1=1$	½
		$\therefore f(1)=(1)^2+5(1)+1=7$	½
		$\therefore f(0)+f(1)=1+7=8$	1
	c)	Find $\frac{dy}{dx}$ If $y=x^n+a^x+e^x+\sin x$	**02**
	Ans	$y=x^n+a^x+e^x+\sin x$	
		$\therefore \frac{dy}{dx}=nx^{n-1}+a^x\log a+e^x+\cos x$	½+½ +½+½
	d)	Evaluate $\int xe^x dx$	**02**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	d) Ans	$\int xe^x dx = x\int e^x dx - \int\left(\int e^x dx.\frac{d}{dx}x\right)dx$	½
		$= xe^x - \int (e^x.1)dx$	½
		$= xe^x - \int e^x dx$	
		$= xe^x - e^x + c$	1
	e)	Evaluate $\int \tan^2 xdx$	**02**
	Ans	$\int \tan^2 xdx$	
		$= \int (\sec^2 x - 1)dx$	1
		$= \tan x - x + c$	1
	f)	Find the area enclosed by the curve $y = 2x$, x-axis and the co-ordinates $x = 1$, $x = 3$	**02**
	Ans	Area $A = \int_a^b ydx$	
		$\therefore A = \int_1^3 2xdx$	½
		$A = 2\left[\frac{x^2}{2}\right]_1^3$ or $A = \left[x^2\right]_1^3$	½
		$A = \left[\frac{3^2}{2} - \frac{1^2}{2}\right]$ or $A = \left[3^2 - 1^2\right]$	½
		$A = 8$	½
	g)	If the coin is tossed 5 times , find the probability of getting head.	**02**
	Ans	$n = 5$, $p = \frac{1}{2}$, $q = \frac{1}{2}, r = 1$	
		$p(r) = {}^nC_r p^r q^{n-r}$	
		$\therefore p(1) = {}^5C_1\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{5-1}$	1
		$\therefore p(1) = \frac{5}{32}$ *or* 0.156	1
2.		**Attempt any THREE of the following:**	**12**
	a)	Find $\frac{dy}{dx}$ if $x\log y + y\log x = 0$	**04**

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	a)	$x\log y + y\log x = 0$	
	Ans	$x\frac{1}{y}\frac{dy}{dx} + \log y.1 + y\frac{1}{x} + \log x\frac{dy}{dx} = 0$	2
		$\therefore \frac{dy}{dx}\left(\frac{x}{y} + \log x\right) = -\log y - \frac{y}{x}$	1
		$\therefore \frac{dy}{dx} = \frac{-\log y - \frac{y}{x}}{\frac{x}{y} + \log x}$	1
		$\therefore \frac{dy}{dx} = \frac{y(-x\log y - y)}{x(x + y\log x)}$	
		---	
	b)	If $x = a\sec t, y = b\tan t,$ find $\frac{dy}{dx}$ at $t = \frac{\pi}{2}$	**04**
	Ans	$x = a\sec t$	
		$\therefore \frac{dx}{dt} = a\sec t\tan t$	1
		$y = b\tan t$	
		$\therefore \frac{dy}{dt} = b\sec^2 t$	1
		$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{b\sec^2 t}{a\sec t\tan t}$	½
		$\frac{dy}{dx} = \frac{b\sec t}{a\tan t} = \frac{b\frac{1}{\cos t}}{a\frac{\sin t}{\cos t}} = \frac{b}{a}\cos ec t$	½
		at $t = \frac{\pi}{2}$	
		$\frac{dy}{dx} = \frac{b}{a}\cos ec\left(\frac{\pi}{2}\right) = \frac{b}{a}(1)$	
		$\frac{dy}{dx} = \frac{b}{a}$	1
		---	
	c)	The rate of working of an engine is given by the expression $10V + \frac{4000}{V}$, where 'V' is the speed of the engine.Find the speed at which the rate of working is the least.	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	Ans	Let $S = 10V + \frac{4000}{V}$	
		$\therefore \frac{dS}{dV} = 10 - \frac{4000}{V^2}$	1
		$\therefore \frac{d^2S}{dV^2} = \frac{8000}{V^3}$	1
		consider $\frac{dS}{dV} = 0$	
		$10 - \frac{4000}{V^2} = 0$	
		$10 = \frac{4000}{V^2}$	
		$V^2 = 400$	
		$V = -20$ or $V = 20$	1
		for V = 20	
		$\frac{d^2S}{dV^2} = \frac{8000}{(20)^3} > 0$	½
		$\therefore S$ is least (minimum) at $V = 20$	½
		--	
	d)	A telegraph wire hangs in the form of a curve $y = a\log\left(\sec\left(\frac{x}{a}\right)\right)$ where 'a' is constant.Show that radius of curvature at any point is $a\sec\left(\frac{x}{a}\right)$	**04**
	Ans	$y = a\log\left(\sec\left(\frac{x}{a}\right)\right)$	
		$\therefore \frac{dy}{dx} = a\frac{1}{\sec\left(\frac{x}{a}\right)}\sec\left(\frac{x}{a}\right)\tan\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\therefore \frac{dy}{dx} = \tan\left(\frac{x}{a}\right)$	
		$\therefore \frac{d^2y}{dx^2} = \sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\therefore$ Radius of curvature is $\rho = \frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$	

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	d)	$\therefore \rho = \dfrac{\left[1+\tan^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)}$	½
		$\therefore \rho = \dfrac{a\left[\sec^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)}$	½
		$\therefore \rho = \dfrac{a\sec^3\left(\frac{x}{a}\right)}{\sec^2\left(\frac{x}{a}\right)}$	
		$\therefore \rho = a\sec\left(\frac{x}{a}\right)$	1
		--	
3.		**Attempt any THREE of the following:**	**12**
	a)	Find the equation of tangent and normal to the curve $4x^2+9y^2=40$ at $(1,2)$	**04**
	Ans	$4x^2+9y^2=40$	
		$8x+18y\dfrac{dy}{dx}=0$	1
		$\therefore \dfrac{dy}{dx}=\dfrac{-4x}{9y}$	
		at $(1,2)$	
		slope of tangent $m=\dfrac{dy}{dx}=\dfrac{-4(1)}{9(2)}=\dfrac{-2}{9}$	½
		Equation of tangent	
		$y-y_1=m(x-x_1)$	
		$y-2=\dfrac{-2}{9}(x-1)$	½
		$9y-18=-2x+2$	
		$2x+9y-20=0$	½
		slope of tangent $=\dfrac{-1}{m}=\dfrac{9}{2}$	½
		Equation of normal is	
		$y-2=\dfrac{9}{2}(x-1)$	½

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	a)	$2y-4=9x-9$ $9x-2y-5=0$	½
	b)	If $\log\left(\sqrt{x^2+y^2}\right)=\tan^{-1}\left(\frac{y}{x}\right)$, find $\frac{dy}{dx}$	**04**
	Ans	$\log\left(\sqrt{x^2+y^2}\right)=\tan^{-1}\left(\frac{y}{x}\right)$	
		$\therefore \frac{1}{\sqrt{x^2+y^2}}\times\frac{1}{2\sqrt{x^2+y^2}}\left(2x+2y\frac{dy}{dx}\right)=\frac{1}{1+\left(\frac{y}{x}\right)^2}\left(\frac{x\frac{dy}{dx}-y.1}{x^2}\right)$	2
		$\frac{1}{\left(x^2+y^2\right)}\left(x+y\frac{dy}{dx}\right)=\frac{x^2}{x^2+y^2}\left(\frac{x\frac{dy}{dx}-y.1}{x^2}\right)$	1
		$\left(x+y\frac{dy}{dx}\right)=x\frac{dy}{dx}-y$ $y\frac{dy}{dx}-x\frac{dy}{dx}=-y-x$ $\frac{dy}{dx}\left(y-x\right)=-y-x$ $\frac{dy}{dx}=\frac{-y-x}{y-x}$	1
	c)	If $y=\log\left(x^2e^x\right)$, find $\frac{dy}{dx}$	**04**
	Ans	$y=\log\left(x^2e^x\right)$ $\frac{dy}{dx}=\frac{1}{x^2e^x}\left(x^2e^x+e^x2x\right)$	3
		$\frac{dy}{dx}=\frac{xe^x\left(x+2\right)}{x^2e^x}$ $\frac{dy}{dx}=\frac{x+2}{x}$	1
	d)	Evaluate $\int\frac{e^{m\sin^{-1}x}}{\sqrt{1-x^2}}\,dx$	**04**

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	d) Ans	$\int \frac{e^{m\sin^{-1}x}}{\sqrt{1-x^2}}\,dx$ Put $\sin^{-1}x = t$ $\therefore \frac{1}{\sqrt{1-x^2}}dx = dt$ $=\int e^{mt}\,dt$ $= \frac{e^{mt}}{m}+c$ $=\frac{e^{m\sin^{-1}x}}{m}+c$	 1 1 1 1
4.		**Attempt any THREE of the following:**	**12**
	a) Ans	Evaluate $\int \frac{1}{\sqrt{x^2+4x+13}}dx$ $\int \frac{dx}{\sqrt{x^2+4x+13}}$ Third term $=\frac{(4)^2}{4}=4$ $=\int \frac{dx}{\sqrt{x^2+4x+4+13-4}}$ $=\int \frac{dx}{\sqrt{(x+2)^2+9}}$ $=\int \frac{dx}{\sqrt{(x+2)^2+3^2}}$ $=\log\left((x+2)+\sqrt{(x+2)^2+3^2}\right)+c$	**04** 1 1 2
	b) Ans	Evaluate $\int \frac{1}{5+4\cos x}dx$ $\int \frac{1}{5+4\cos x}\,dx$ Put $\tan\frac{x}{2}=t$, $\cos x = \frac{1-t^2}{1+t^2}$ $dx=\frac{2dt}{1+t^2}$	**04**

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	b)	$\therefore \int \frac{dx}{5+4\cos x} = \int \frac{1}{5+4\left(\frac{1-t^2}{1+t^2}\right)} \cdot \frac{2dt}{1+t^2}$	1
		$= 2\int \frac{1}{t^2+9}\,dt$	1
		$= 2\int \frac{1}{t^2+3^2}\,dt$	
		$= 2\times\frac{1}{3}\tan^{-1}\left(\frac{t}{3}\right)+c$	1
		$= \frac{2}{3}\tan^{-1}\left(\frac{\tan\frac{x}{2}}{3}\right)+c$	1
		--	
	c)	Evaluate $\int x.\log(x+1)\,dx$	**04**
	Ans	$\int x.\log(x+1)\,dx$	
		$= \log(x+1)\int x dx - \int\left(\int x dx.\frac{d}{dx}\log(x+1)\right)dx$	1
		$= \log(x+1)\frac{x^2}{2} - \int\left(\frac{x^2}{2}\frac{1}{x+1}\right)dx$	
		$= \log(x+1)\frac{x^2}{2} - \frac{1}{2}\int\left(\frac{x^2}{x+1}\right)\,dx$	1
		$\begin{array}{r} x-1 \\ x+1\overline{)x^2} \\ -\underline{x^2+x} \\ -x \\ \underline{-x-1} \\ 1 \end{array}$	
		$\frac{x^2}{x+1} = (x-1)+\frac{1}{x+1}$	1
		$\therefore I = \log(x+1)\frac{x^2}{2} - \frac{1}{2}\int\left((x-1)+\frac{1}{x+1}\right)dx$	
		$\therefore I = \frac{1}{2}\left(\log(x+1)x^2 - \left(\frac{x^2}{2} - x + \log(x+1)\right)\right)+c$	1
		--	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	d)	Evaluate $\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}\,dx$	**04**
	Ans	$\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}\,dx$ Put $\tan x = t$, $\therefore \sec^2 x dx = dt$	
		$\therefore \int \frac{1}{(1+t)(2+t)}\,dt$	1
		$\frac{1}{(1+t)(2+t)} = \frac{A}{1+t}+\frac{B}{2+t}$	
		$1 = A(2+t)+B(1+t)$	
		$\therefore$ Put $t=-1$, $A=1$	½
		Put $t=-2$, $B=-1$	½
		$\therefore \frac{1}{(1+t)(2+t)} = \frac{1}{1+t}-\frac{1}{2+t}$	
		$\therefore \int \frac{1}{(1+t)(2+t)}\,dt = \int\left(\frac{1}{1+t}-\frac{1}{2+t}\right)dt$	½
		$=\log(1+t)-\log(2+t)+c$	1
		$=\log(1+\tan x)-\log(2+\tan x)+c$	½
		OR	
		$\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}dx$ Put $\tan x = t$, $\therefore \sec^2 x dx = dt$	
		$\int \frac{1}{(1+t)(2+t)}\,dt$	1
		$=\int \frac{1}{t^2+3t+2}dt$	
		Third Term $=\frac{3^2}{4}=\frac{9}{4}$	1
		$=\int \frac{1}{t^2+3t+\frac{9}{4}-\frac{9}{4}+2}dt$	
		$=\int \frac{1}{\left(t+\frac{3}{2}\right)^2-\left(\frac{1}{2}\right)^2}dt$	½
		$=\frac{1}{2\frac{1}{2}}\log\left\lvert\frac{t+\frac{3}{2}-\frac{1}{2}}{t+\frac{3}{2}+\frac{1}{2}}\right\rvert+c$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	d)	$=\log\left\|\frac{t+1}{t+2}\right\|+c$	
		$=\log\left\|\frac{\tan x+1}{\tan x+2}\right\|+c$	½
		--	**04**
	e)	Evaluate : $\int_0^4 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5}+\sqrt[3]{9-x}}dx$	
	Ans	$I=\int_0^4 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5}+\sqrt[3]{9-x}}dx---------(1)$	
		$I=\int_0^4 \frac{\sqrt[3]{4-x+5}}{\sqrt[3]{4-x+5}+\sqrt[3]{9-(4-x)}}dx$	1
		$I=\int_0^4 \frac{\sqrt[3]{9-x}}{\sqrt[3]{9-x}+\sqrt[3]{x+5}}dx---------(2)$	
		Add (1) and (2)	
		$\therefore 2I=\int_0^4 \frac{\sqrt[3]{9-x}+\sqrt[3]{x+5}}{\sqrt[3]{9-x}+\sqrt[3]{x+5}}dx$	½
		$\therefore 2I=\int_0^4 1\cdot dx$	½
		$\therefore 2I=[x]_0^4$	1
		$\therefore 2I=4-0$	½
		$\therefore I=2$	½
		OR	
		$I=\int_0^4 \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5}+\sqrt[3]{9-x}}dx$ Replace $x\to 4-x$; $\therefore x+5\to 9-x$ & $9-x\to x+5$	
		$\therefore I=\int_0^4 \frac{\sqrt[3]{9-x}}{\sqrt[3]{9-x}+\sqrt[3]{x+5}}dx$	1
		$\therefore 2I=\int_0^4 \frac{\sqrt[3]{9-x}+\sqrt[3]{x+5}}{\sqrt[3]{9-x}+\sqrt[3]{x+5}}dx$	½
		$=\int_0^4 1\cdot dx$	½
		$\therefore 2I=[x]_0^4$	1
		$\therefore 2I=4-0$	½
		$\therefore I=2$	½
		--	
5.		**Attempt any TWO of the following:**	**12**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	a)	Find the area bounded by the parabola $y^2=9x$ and $x^2=9y$.	**06**
	Ans	$y^2=9x$ ---------(1)	
		$x^2=9y$	
		$\therefore y=\frac{x^2}{9}$	
		$\therefore \text{eq}^n.(1)\Rightarrow\left(\frac{x^2}{9}\right)^2=9x$	
		$\frac{x^4}{81}=9x$	
		$\therefore x^4=729x$	
		$\therefore x^4-729x=0$	
		$\therefore x\left(x^3-9^3\right)=0$	
		$\therefore x=0,9$	1
		Area $A=\int_a^b\left(y_1-y_2\right)dx$	
		$\therefore A=\int_0^9\left(3\sqrt{x}-\frac{x^2}{9}\right)dx$	1
		$\therefore A=\left(\frac{3x^{\frac{3}{2}}}{\frac{3}{2}}-\frac{x^3}{27}\right)_0^9$	2
		$\therefore A=\left(\frac{3(9)^{\frac{3}{2}}}{\frac{3}{2}}-\frac{(9)^3}{27}\right)-0$	1
		$\therefore A=27$	1
		--	
	b)	Attempt the following:	**06**
	(i)	Form the differential equation by eliminating the arbitrary constants if $y=A\cos 3x+B\sin 3x$	**03**
	Ans	$y=A\cos 3x+B\sin 3x$	
		$\therefore \frac{dy}{dx}=-3A\sin 3x+3B\cos 3x$	1
		$\therefore \frac{d^2y}{dx^2}=-9A\cos 3x-9B\sin 3x$	1
		$\therefore \frac{d^2y}{dx^2}=-9\left(A\cos 3x+B\sin 3x\right)$	½

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	b)	$\frac{d^2y}{dx^2}=-9y$	
		$\frac{d^2y}{dx^2}+9y=0$	½
	b) (ii)	Solve : $e^{x+y}dx+e^{2y-x}dy=0$	**03**
	Ans	$e^{x+y}dx+e^{2y-x}dy=0$	
		$\therefore e^xe^ydx+e^{2y}e^{-x}dy=0$	
		$\frac{e^x}{e^{-x}}dx=-\frac{e^{2y}}{e^y}dy$	1
		$e^{2x}dx=-e^ydy$	
		$\int e^{2x}dx=-\int e^ydy$	1
		$\frac{e^{2x}}{2}=-e^y+c$	1
	(c)	A body moves according to the law of motion is given by $\frac{d^2x}{dt^2}$=3t^2. Find its velocity at $t=1$ & $v=2$	**06**
	Ans	Acceleration $=\frac{d^2x}{dt^2}=\frac{dv}{dt}=3t^2$	1
		$\therefore dv=3t^2dt$	1
		$\therefore \int dv=\int 3t^2dt$	1
		$\therefore v=\frac{3t^3}{3}+c$	1
		given $v=2$ and $t=1$	
		$\therefore c=1$	1
		$\therefore v=t^3+1$	1
6.		**Attempt any TWO of the following:**	**12**
	a)	Attempt the following:	**06**
	i)	On an average 2% of the population in an area suffer from T.B. What is the probability that out of 5 persons chosen at random from this area, atleast two suffer from T.B ?	**03**
	Ans	$n=5$, $p=2\%=\frac{2}{100}=0.02$	
		Mean $m=np$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	a) i)	$\therefore m = 5 \times 0.02 = 0.1$	1
		$p(r) = \dfrac{e^{-m} m^r}{r!}$	
		$\therefore p(\text{atleast two}) = 1 - [p(0) + p(1)]$	
		$= 1 - \left[\dfrac{e^{-0.1}(0.1)^0}{0!} + \dfrac{e^{-0.1}(0.1)^1}{1!}\right]$	1
		$= 0.0047$	1
	ii)	10% of the components manufactured by company are defective .If twelve components selected at random , find the probability that atleast two will be defective.	**03**
	Ans	Given $p = 10\% = \dfrac{10}{100} = 0.1, n = 12$ and $q = 1 - p = 0.9$	1
		$p(r) = {}^nC_r p^r q^{n-r}$	
		$p(\text{atleast two}) = 1 - [p(0) + p(1)]$	
		$= 1 - \left[{}^{12}C_0 (0.1)^0 (0.9)^{12-0} + {}^{12}C_1 (0.1)^1 (0.9)^{12-1}\right]$	1
		$= 0.3409$	1
	b)	The number of road accidents met with by taxi drivers follow poisson distribution with mean 2 out of 5000 taxi in the city ,find the number of drivers. (i) Who does not meet an accident. (ii) Who met with an accidents more than 3 times. $\left(\text{Given } e^{-2} = 0.1353\right)$	**06**
	Ans	Let $N = 5000$, Mean $m = 2$	
		$p(r) = \dfrac{e^{-m} m^r}{r!}$	
		(i) $r = 0 \quad \therefore p(0) = \dfrac{e^{-2} 2^0}{0!}$	1
		$\therefore p(0) = 0.1353$	1
		Number of taxi drivers $= N \times p = 5000 \times 0.1353 = 676.5 \cong 677$	1
		(ii) More than three	
		$= 1 - \left[\dfrac{e^{-2}2^0}{0!} + \dfrac{e^{-2}2^1}{1!} + \dfrac{e^{-2}2^2}{2!} + \dfrac{e^{-2}2^3}{3!}\right]$	1
		$= 0.1429$	1

WINTER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22206**

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	b)	Number of taxi drivers $= N \times p = 5000 \times 0.1429 = 714.5 \approx 715$	1
		--	
	c)	Weight of 4000 students are found to be normally distributed with mean 50 kgs and standard deviation 5 kgs.Find the number of students with weights (i) less than 45 kgs (ii) between 45 and 60 kgs (Given: For a standard normal variate z area under the curve between $z=0$ and $z=1$ is 0.3413 and that between $z=0$ and $z=2$ is 0.4772)	**06**
	Ans	Given $\bar{x}=50$, $\sigma=5$, $N=4000$	
		(i) For $x=45$, $z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{45-50}{5}=-1$	1
		$\therefore p(\text{less than } 45)=A(\text{less than } -1)$ $=0.5-A(1)$	
		$=0.5-0.3413$	1
		$=0.1587$	
		$\therefore$ No.of students $= N \cdot p$ $=4000\times 0.1587=634.8$ *i.e.*, 635	1
		(ii)For $x=45$, $z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{45-50}{5}=-1$	
		For $x=60$, $z=\dfrac{x-\bar{x}}{\sigma}=\dfrac{60-50}{5}=2$	1
		$\therefore p(\text{ between 45 and 60})=A(-1)+A(2)$ $=0.3413+0.4772$	
		$=0.8185$	1
		$\therefore$ No.of students $= N \cdot p = 4000\times 0.8185$ $=3274$	1
		--	
		Important Note *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.* -- --	

22203

21718

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: 10

a) State principle of transmisibility of force.

b) Define load lost in friction.

c) Define resultant force.

d) State Lami's theorem.

e) Define angle of repose.

f) Define centre of gravity.

g) State any two types of beam along with sketch.

Marks

2. Attempt any THREE of the following: **12**

a) Define unlike parallel force system and general force system with sketch.

b) In a machine, an effort required to lift a certain load is 200 N. When efficiency is 60% find the ideal effort.

c) What are the characteristic of ideal machine?

d) State four laws of static friction.

3. Attempt any THREE of the following: **12**

a) Find the angle between two equal forces of magnitude 300 N each, if their resultant is 150 N.

b) Find analytically the resultant of following concurrent force system. Refer to Figure No. 1.

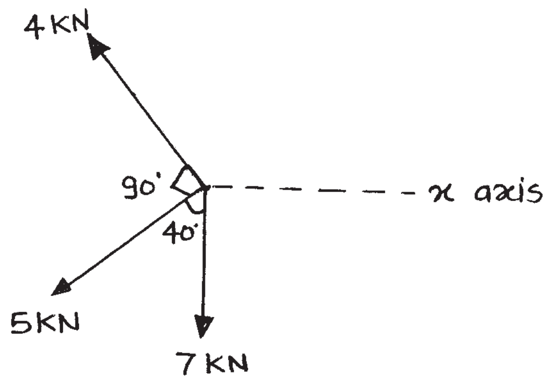

Fig. No. 1

c) The diameter of bigger and smaller Pulley's of Weston's differential pulley block are 250 mm and 100 mm respectively. Determine effort required to lift a load of 3 KN with 80% efficiency.

d) A machine has V.R. of 250 and has its law P = (0.01W + 5) N, Find M.A., efficiency, effort lost in friction at a load of 1000 N and also state whether machine is reversible or not.

Marks

4. Attempt any THREE of the following: 12

a) Calculate the resultant and it's position wrt. point A for the force system shown in Figure No. 2. AB = BC = CA = 2m

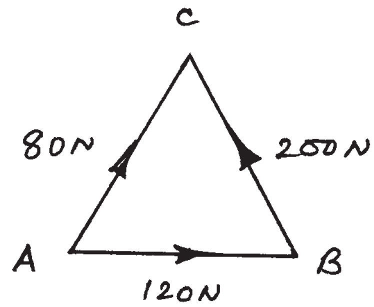

Fig. No. 2

b) Calculate the tension induced in the cable used for the assembly shown in Figure No. 3. W = 1500 N.

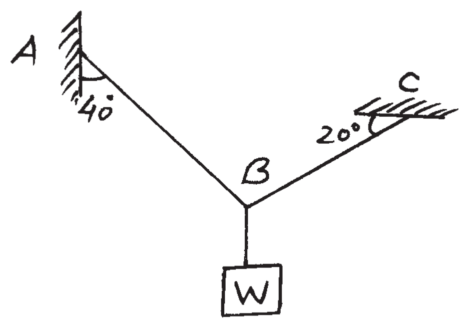

Fig. No. 3

c) Calculate the reaction of beam loaded as shown in Figure No. 4.

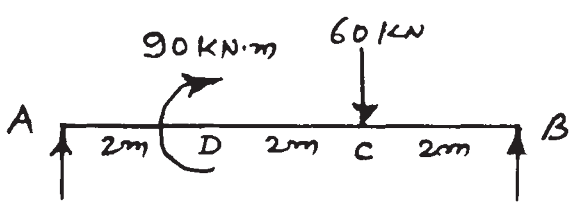

Fig. No. 4

d) A block weighing 1000 N, resting on a horizontal plane requires a pull of 400 N to start its motion. When applied at an angle of 30° with the horizontal. Find the coefficient of friction, along with normal reaction, force of friction and resultant reaction.

Marks

e) Calculate the reaction of beam loaded as shown in Figure No. 5 use graphical method.

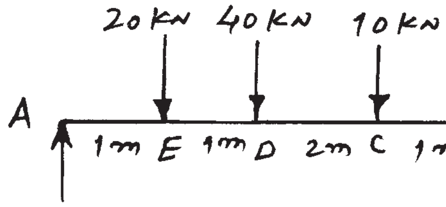

Fig. No. 5

5. Attempt any TWO of the following: **12**

a) Calculate reactions of beam loaded as shown in Figure No. 6.

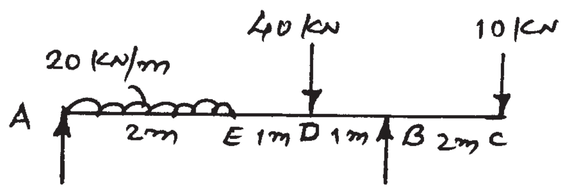

Fig. No. 6

b) A push of 30 N applied at 30° to horizontal just move the block of weight 'W' N. If angle of friction is 16°. Find coefficient of friction, total reaction and weight of block.

c) A concurrent force system is shown in Figure No. 7 find graphically the resultant of this force system.

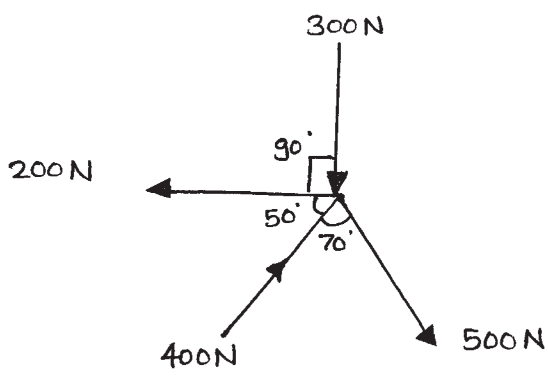

Fig. No. 7

Marks

6. Attempt any TWO of the following: **12**

a) Locate the position of centroid for the section shown in Figure No. 8.

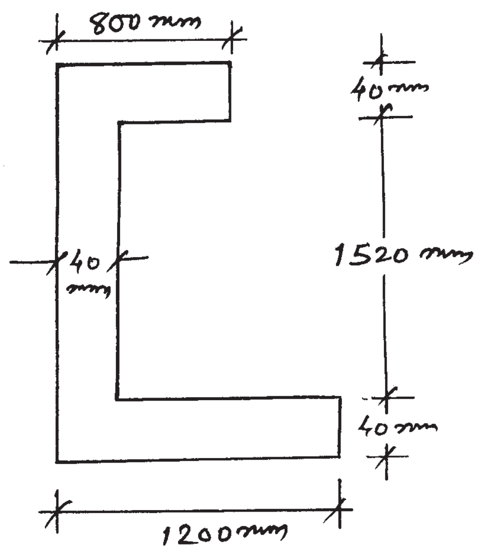

Fig. No. 8

b) Locate the centroid of lamina shown in Figure No. 9.

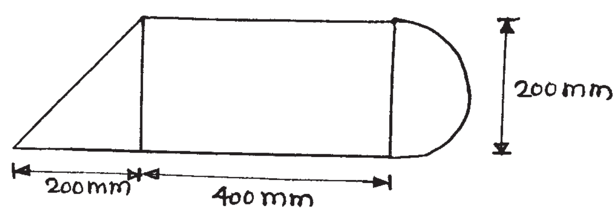

Fig. No. 9

c) Find the centre of gravity for the solid shown in Figure No. 10.

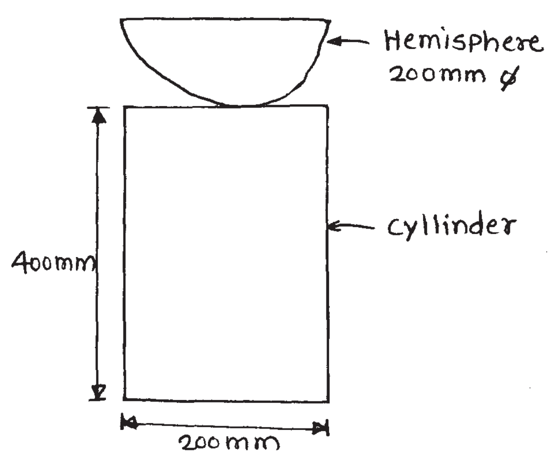

Fig. No. 10

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

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 answer 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.	Answer	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	State whether the function $f(x)=\frac{a^x+a^{-x}}{2}$ is even or odd .	**02**
	Ans	$f(x)=\frac{a^x+a^{-x}}{2}$	
		$\therefore f(-x)=\frac{a^{-x}+a^{-(-x)}}{2}$	1
		$=\frac{a^{-x}+a^{x}}{2}$	½
		$=f(x)$	
		$\therefore$ function is even.	½
	b)	If $f(x)=x^2+6x+10$ find $f(2)+f(-2)$	**02**
	Ans	$f(x)=x^2+6x+10$	
		$\therefore f(2)=(2)^2+6(2)+10=26$	½
		$\therefore f(-2)=(-2)^2+6(-2)+10=2$	½
		$\therefore f(2)+f(-2)=26+2=28$	1
	c)	If $y=\log(x^2+2x+5)$, find $\frac{dy}{dx}$	**02**
	Ans	$y=\log(x^2+2x+5)$	
		$\therefore \frac{dy}{dx}=\frac{1}{x^2+2x+5}(2x+2)$	02

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.		$\therefore \frac{dy}{dx}=\frac{2x+2}{x^2+2x+5}$	
	d)	Evaluate : $\int \frac{1}{\sin^2 x\cos^2 x}\ dx$	**02**
	Ans	$\int \frac{1}{\sin^2 x\cos^2 x}\ dx$	
		$=\int \frac{\sin^2 x+\cos^2 x}{\sin^2 x\cos^2 x}\ dx$	½
		$=\int \frac{1}{\cos^2 x}+\frac{1}{\sin^2 x}\ dx$	½
		$=\int \left(\sec^2 x+\cos ec^2 x\right)dx$	½
		$=\tan x-\cot x+c$	½
		OR	
		$\int \frac{1}{\sin^2 x\cos^2 x}\ dx$	
		$=\int \cos ec^2 x.\sec^2 x\ dx$	½
		$=\int \left(1+\cot^2 x\right)\left(1+\tan^2 x\right)dx$	½
		$=\int \left(1+\tan^2 x+\cot^2 x+\tan^2 x\cot^2 x\right)dx$	
		$=\int \left(1+\tan^2 x+\cot^2 x+1\right)dx$	
		$=\int \left(\sec^2 x+\cos ec^2 x\right)dx$	½
		$=\tan x-\cot x+c$	½
	e)	Find the area enclosed by the curve $y=3x^2$, x-axis and the ordinates $x=1$, $x=3$	**02**
	Ans	Area $A=\int_a^b y dx$	
		$=\int_1^3 3x^2 dx$	½
		$=3\left[\frac{x^3}{3}\right]_1^3$ OR $=\left[x^3\right]_1^3$	½
		$=3\left[\frac{3^3}{3}-\frac{1^2}{3}\right]$ $=\left[3^3-1^3\right]$	½
		$=26$	½

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
1.	f)	An unbaised coin is tossed 5 times .Find the probability of getting a head.	**02**
	Ans	$n=5, p=\frac{1}{2}, q=\frac{1}{2}, r=1$	½
		$p(r)=nc_r(p)^r(q)^{n-r}$	
		$p(1)=5c_1\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{5-1}$	½
		$=\frac{5}{32}$ *or* 0.156	1
		-----------------------------------	
	g)	Evaluate: $\int x\cos x dx$	**02**
	Ans	$\int x\cos x dx = x\int \cos x dx - \int\left(\int \cos x dx.\frac{d}{dx}x\right)dx$	½
		$= x\sin x - \int(\sin x.1)dx$	1
		$= x\sin x + \cos x + c$	½

2		**Attempt any THREE of the following:**	**12**
	(a)	If $e^x+e^y=e^{x+y}$, find $\frac{dy}{dx}$	**04**
	Ans	$e^x+e^y=e^{x+y}$	
		$e^x+e^y\frac{dy}{dx}=e^{x+y}\left[1+\frac{dy}{dx}\right]$	1
		$e^y\frac{dy}{dx}-e^{x+y}\frac{dy}{dx}=e^{x+y}-e^x$	1
		$\frac{dy}{dx}\left(e^y-e^{x+y}\right)=e^{x+y}-e^x$	1
		$\frac{dy}{dx}=\frac{e^{x+y}-e^x}{e^y-e^{x+y}}$	1
		-----------------------------------	
	b)	If $x=a(\theta+\sin\theta), y=a(1-\cos\theta)$, find $\frac{dy}{dx}$ at $\theta=\frac{\pi}{2}$	**04**
	Ans	$x=a(\theta+\sin\theta)$	
		$\frac{dx}{d\theta}=a(1+\cos\theta)$	1
		$y=a(1-\cos\theta)$	

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	b)	$\frac{dy}{d\theta}=a\left(-\left(-\sin\theta\right)\right)=a\sin\theta$	1
		$\frac{dy}{dx}=\frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}=\frac{a\sin\theta}{a\left(1+\cos\theta\right)}$	
		$=\frac{\sin\theta}{\left(1+\cos\theta\right)}$ OR $=\frac{2\sin\frac{\theta}{2}\cos\frac{\theta}{2}}{2\cos^2\frac{\theta}{2}}=\tan\frac{\theta}{2}$	½
		at $\theta=\frac{\pi}{2}$, $\frac{dy}{dx}=\frac{\sin\frac{\pi}{2}}{\left(1+\cos\frac{\pi}{2}\right)}$ $=\tan\frac{\pi}{4}$	½
		$=\frac{1}{1+0}=1$ $=1$	1
	c)	Find the maximum and minimum values of $y=2x^3-3x^2-36x+10$	**04**
	Ans	Let $y=2x^3-3x^2-36x+10$	
		$\therefore\frac{dy}{dx}=6x^2-6x-36$	½
		$\therefore\frac{d^2y}{dx^2}=12x-6$	½
		Consider $\frac{dy}{dx}=0$	
		$6x^2-6x-36=0$	
		$x^2-x-6=0$	
		$\therefore x=-2\ ,\ x=3$	1
		at $x=-2$	
		$\frac{d^2y}{dx^2}=12\left(-2\right)-6=-30<0$	½
		$\therefore y$ is maximum at $x=-2$	
		$y_{\max}=2\left(-2\right)^3-3\left(-2\right)^2-36\left(-2\right)+10$	
		$=54$	½
		$at\ \ x=3,\ \ \frac{d^2y}{dx^2}=12\left(3\right)-6=30>0$	½
		$\therefore y$ is minimum at $x=3$	
		$y_{\min}=2\left(3\right)^3-3\left(3\right)^2-36\left(3\right)+10$	
		$=\ -71$	½

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
2.	d)	A telegraph wire hangs in the form of a curve $y = a\log\left(\sec\left(\frac{x}{a}\right)\right)$ where $'a'$ is constant.Show that radius of curvature at any point is $a\sec\left(\frac{x}{a}\right)$	**04**
	Ans	$y = a\log\left(\sec\left(\frac{x}{a}\right)\right)$	
		$\frac{dy}{dx} = a\frac{1}{\sec\left(\frac{x}{a}\right)}\sec\left(\frac{x}{a}\right)\tan\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\frac{dy}{dx} = \tan\left(\frac{x}{a}\right)$	
		$\frac{d^2y}{dx^2} = \sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\therefore$ Radius of curvature is $\rho = \frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$	
		$\therefore \rho = \frac{\left[1+\tan^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)}$	½
		$\therefore \rho = \frac{a\left[\sec^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)}$	½
		$\therefore \rho = \frac{a\sec^3\left(\frac{x}{a}\right)}{\sec^2\left(\frac{x}{a}\right)}$	½
		$\therefore \rho = a\sec\left(\frac{x}{a}\right)$	½
		--	
3		**Attempt any THREE of the following:**	**12**
	a)	Find the equation of tangent and normal to the curve $y = 2x - x^2$ at (2,0)	**04**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	Ans	$y = 2x - x^2$	
		$\frac{dy}{dx} = 2 - 2x$	1
		at (2,0)	
		slope of tangent $m = \frac{dy}{dx} = 2 - 2(2) = -2$	½
		equation of tangent is,	
		$y - y_1 = m(x - x_1)$	
		$y - 0 = -2(x - 2)$	½
		$y = -2x + 4$	
		$2x + y - 4 = 0$	½
		slope of normal $m' = -\frac{1}{m} = \frac{1}{2}$	½
		equation of normal is,	
		$y - y_1 = m'(x - x_1)$	
		$y - 0 = \frac{1}{2}(x - 2)$	½
		$2y = x - 2$	
		$x - 2y - 2 = 0$	½
		--	
	b)	Differentiate $(\sin x)^{\tan x}$ w.r.t.x	**04**
	Ans	Let y = $(\sin x)^{\tan x}$	
		$\log y = \tan x \log(\sin x)$	½
		$\frac{1}{y}\frac{dy}{dx} = \tan x \frac{1}{\sin x}\cos x + \log(\sin x)\sec^2 x$	2
		$\frac{dy}{dx} = y\left(\tan x \cot x + \log(\sin x)\sec^2 x\right)$	1
		$\frac{dy}{dx} = (\sin x)^{\tan x}\left(1 + \log(\sin x)\sec^2 x\right)$	½
		--	
	c)	If $Y = \sqrt{\frac{1-\cos 2x}{1+\cos 2x}}$, find $\frac{dy}{dx}$	**04**
	Ans	$y = \sqrt{\frac{1-\cos 2x}{1+\cos 2x}}$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
3.	c)	$y=\sqrt{\dfrac{2\sin^2 x}{2\cos^2 x}}$	1
		$y=\sqrt{\tan^2 x}$	1
		$y=\tan x$	1
		$\dfrac{dy}{dx}=\sec^2 x$	1
		----------	
	d)	Evaluate: $\int \dfrac{\sin\sqrt{x}}{\sqrt{x}}\,dx$	**04**
	Ans	$\int \dfrac{\sin\sqrt{x}}{\sqrt{x}}\,dx$	
		Put $\sqrt{x}=t$	
		$\therefore \dfrac{1}{2\sqrt{x}}dx=dt$	1
		$\therefore \dfrac{1}{\sqrt{x}}dx=2dt$	½
		$=\int \sin t\left(2dt\right)$	½
		$=-2\cos t+c$	1½
		$=-2\cos\sqrt{x}+c$	½

4		**Attempt any THREE of the following:**	**12**
	a)	Evaluate: $\int \dfrac{1}{\sqrt{1-x^2}\left(\sin^{-1}x\right)^2}\,dx$	**04**
	Ans	$\int \dfrac{1}{\sqrt{1-x^2}\left(\sin^{-1}x\right)^2}\,dx$	
		Put $\sin^{-1}x=t$	
		$\therefore \dfrac{1}{\sqrt{1-x^2}}dx=dt$	1
		$=\int \dfrac{1}{t^2}\,dt$	1
		$=\int t^{-2}\,dt$	½
		$=\dfrac{t^{-1}}{-1}+c$	1

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	a)	$=-\left(\sin^{-1}x\right)^{-1}+c$	½
		--	
	b)	Evaluate : $\int\frac{1}{5+4\cos x}dx$	**04**
	Ans	$\int\frac{1}{5+4\cos x}dx$	
		Put $\tan\frac{x}{2}=t$ $\cos x=\frac{1-t^2}{1+t^2}, dx=\frac{2dt}{1+t^2}$	
		$\therefore\int\frac{dx}{5+4\cos x}=\int\frac{1}{5+4\left(\frac{1-t^2}{1+t^2}\right)}\cdot\frac{2dt}{1+t^2}$	1
		$=2\int\frac{1}{t^2+9}dt$	1
		$=2\int\frac{1}{t^2+3^2}dt$	½
		$=2\times\frac{1}{3}\tan^{-1}\left(\frac{t}{3}\right)+c$	1
		$=\frac{2}{3}\tan^{-1}\left(\frac{\tan\frac{x}{2}}{3}\right)+c$	½
		--	
	c)	Evaluate: $\int\frac{x}{1+\cos 2x}dx$	**04**
	Ans	$\int\frac{x}{1+\cos 2x}dx$	
		$=\int\frac{x}{2\cos^2 x}dx$	½
		$=\frac{1}{2}\int x\sec^2 x dx$	½
		$=\frac{1}{2}\left[x\int\sec^2 x dx-\int\left(\int\sec^2 x dx.\frac{d}{dx}x\right)dx\right]$	1
		$=\frac{1}{2}\left[x\tan x-\int\tan x.1dx\right]$	1
		$=\frac{1}{2}\left[x\tan x-\log\left(\sec x\right)\right]+c$	1
		--	

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	d)	Evaluate : $\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}$	**04**
	Ans	$\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}dx$ Put $\tan x = t$, $\therefore \sec^2 x dx = dt$	1
		$\int \frac{1}{(1+t)(2+t)}dt$	
		$\frac{1}{(1+t)(2+t)} = \frac{A}{1+t} + \frac{B}{2+t}$	½
		$1 = A(2+t) + B(1+t)$	
		$\therefore$ Put $t=-1$, $A=1$	½
		Put $t=-2$, $B=-1$	½
		$\therefore \frac{1}{(1+t)(2+t)} = \frac{1}{1+t} - \frac{1}{2+t}$	
		$\int \frac{1}{(1+t)(2+t)}dt = \int\left(\frac{1}{1+t} - \frac{1}{2+t}\right)dt$	
		$= \log[1+t] - \log[2+t] + c$	1
		$= \log[1+\tan x] - \log[2+\tan x] + c$	½
		OR	
		$\int \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}dx$ Put $\tan x = t$, $\therefore \sec^2 x dx = dt$	1
		$\int \frac{1}{(1+t)(2+t)}dt$	
		$= \int \frac{1}{t^2+3t+2}dt$	½
		$= \int \frac{1}{t^2+3t+\frac{9}{4}-\frac{9}{4}+2}dt$	½
		$= \int \frac{1}{\left(t+\frac{3}{2}\right)^2 - \left(\frac{1}{2}\right)^2}dt$	½
		$= \frac{1}{2\frac{1}{2}}\log\left\|\frac{t+\frac{3}{2}-\frac{1}{2}}{t+\frac{3}{2}+\frac{1}{2}}\right\| + c$	1
		$= \log\left\|\frac{t+1}{t+2}\right\| + c$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.		$=\log\left\|\frac{\tan x+1}{\tan x+2}\right\|+c$	½
		--	
	e)	Evaluate : $\int_0^{\pi/2}\frac{\sqrt[3]{\sin x}}{\sqrt[3]{\cos x}+\sqrt[3]{\sin x}}dx$	**04**
	Ans	$I=\int_0^{\pi/2}\frac{\sqrt[3]{\sin x}}{\sqrt[3]{\cos x}+\sqrt[3]{\sin x}}dx---------(1)$	
		$=\int_0^{\pi/2}\frac{\sqrt[3]{\sin\left(\frac{\pi}{2}-x\right)}}{\sqrt[3]{\cos\left(\frac{\pi}{2}-x\right)}+\sqrt[3]{\sin\left(\frac{\pi}{2}-x\right)}}dx$	1
		$I=\int_0^{\pi/2}\frac{\sqrt[3]{\cos x}}{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}dx---------(2)$	½
		Add (1) and (2)	
		$\therefore 2I=\int_0^{\pi/2}\frac{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}dx$	½
		$=\int_0^{\pi/2}1\cdot dx$	
		$=[x]_0^{\pi/2}$	1
		$2I=\frac{\pi}{2}$	
		$\therefore I=\frac{\pi}{4}$	1
		OR	
		$I=\int_0^{\pi/2}\frac{\sqrt[3]{\sin x}}{\sqrt[3]{\cos x}+\sqrt[3]{\sin x}}dx$ Replace $x\to\frac{\pi}{2}-x$, $\therefore \sin x\to\cos x$ & $\cos x\to\sin x$	1
		$\therefore I=\int_0^{\pi/2}\frac{\sqrt[3]{\cos x}}{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}dx$	½
		$\therefore 2I=\int_0^{\pi/2}\frac{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}}dx$	½
		$=\int_0^{\pi/2}1\cdot dx$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
4.	e)	$=\left[x\right]_0^{\pi/2}$	1
		$2I=\dfrac{\pi}{2}$	
		$\therefore I=\dfrac{\pi}{4}$	1
		--	
5		**Attempt any TWO of the following:**	**12**
	a)	Find the area of the region bounded by the parabola $y=4x-x^2$ and the x-axis.	**06**
	Ans	$y=4x-x^2$	
		put $y=0$,	
		$4x-x^2=0$	
		$x=0, x=4$	1
		Area$=\int_a^b ydx$	
		$=\int_0^4\left(4x-x^2\right)dx$	1
		$=4\left[\dfrac{x^2}{2}\right]_0^4-\left[\dfrac{x^3}{3}\right]_0^4$ OR $=\left[4\dfrac{x^2}{2}-\dfrac{x^3}{3}\right]_0^4$	2
		$=4\left[\dfrac{4^2}{2}-\dfrac{0^2}{2}\right]-\left[\dfrac{4^3}{3}-\dfrac{0^3}{3}\right]$ OR $=\left[\left(2(4)^2-\dfrac{4^3}{3}\right)-0\right]$	1
		$=\dfrac{32}{3}=10.667$	1
		--	
	b)	Attempt the following:	**06**
	(i)	Form the D.E. by eliminating the arbitrary constants if $y=A\cos 3x+B\sin 3x$	**03**
	Ans	$y=A\cos 3x+B\sin 3x$	
		$\therefore \dfrac{dy}{dx}=-3A\sin 3x+3B\cos 3x$	1
		$\therefore \dfrac{d^2y}{dx^2}=-9A\cos 3x-9B\sin 3x$	1
		$\therefore \dfrac{d^2y}{dx^2}=-9\left(A\cos 3x+B\sin 3x\right)$	½
		$\dfrac{d^2y}{dx^2}=-9y$	½
		$\dfrac{d^2y}{dx^2}+9y=0$	

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	b)(ii)	Solve : $x\left(1+y^2\right)dx+y\left(1+x^2\right)dy=0$	**03**
	Ans	$x\left(1+y^2\right)dx+y\left(1+x^2\right)dy=0$	
		$\therefore \frac{x}{1+x^2}dx=-\frac{y}{1+y^2}dy$	1
		$\therefore \int\frac{x}{1+x^2}dx=-\int\frac{y}{1+y^2}dx$	1
		$\therefore \frac{1}{2}\log\left(1+x^2\right)=-\frac{1}{2}\log\left(1+y^2\right)+c$	1
		$\therefore \log\left(1+x^2\right)=-\log\left(1+y^2\right)+C$	
		--	
	(c)	A particle starting with velocity 6m/sec has an acceleration $\left(1-t^2\right)$ m/sec^2, when does it first come to rest? How far has it then travelled?	**06**
	Ans	Acceleration = $\frac{dv}{dt}=1-t^2$	
		$\therefore dv=\left(1-t^2\right)dt$	
		$\therefore \int dv=\int\left(1-t^2\right)dt$	
		$\therefore v=t-\frac{t^3}{3}+c$	1
		given $v=6$ and initially $t=0$	
		$\therefore c=6$	½
		$\therefore v=t-\frac{t^3}{3}+6$	
		The particle comes to rest when $v=0$	
		$\therefore t-\frac{t^3}{3}+6=0$	½
		$\therefore t^3-3t-18=0$	
		$\therefore t=3$	1
		$\therefore v=\frac{dx}{dt}$	
		$\therefore \frac{dx}{dt}=t-\frac{t^3}{3}+6$	½
		$\therefore dx=\left(t-\frac{t^3}{3}+6\right)dt$	
		$\therefore \int dx=\int\left(t-\frac{t^3}{3}+6\right)dt$	

Q. No.	Sub Q. N.	Answer	Marking Scheme
5.	c)	$\therefore x=\frac{t^2}{2}-\frac{t^4}{12}+6t+c_1$	1
		$\therefore$ initially $x=0$, $t=0$	
		$c_1=0$	½
		$\therefore x=\frac{t^2}{2}-\frac{t^4}{12}+6t$	
		put $t=3$	
		$\therefore x=\frac{(3)^2}{2}-\frac{(3)^4}{12}+6(3)$	
		$\therefore x=15.75$	1
		--	
6		**Attempt any TWO of the following:**	**12**
	a)	Attempt the following:	**06**
	i)	A person fires 10 shots at target.The probability that any shot will hit the target 3/5. Find the probability that the target is hit exactly 5 times.	**03**
	Ans	$n=10, p=\frac{3}{5}$	
		$q=1-p=1-\frac{3}{5}=\frac{2}{5}$	
		$r=5$	
		$p(r)={}^{n}c_r\,(p)^r\,(q)^{n-r}$	
		$p(5)={}^{10}c_5\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^{10-5}$	2
		=0.2007	1
		--	
	ii)	If 20% of the bolt produce by a machine are defective .Find the Probability that out of 4 bolts drawn , (1) one is defective (2) at the most two are defective.	**03**
	Ans	Given $p=20\%=\frac{20}{100}=0.2, n=4$ and $q=1-p=0.8$	
		$p(r)={}^{n}C_r\,p^r q^{n-r}$	

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.	a)(ii)	(1) $p(\text{one is defective})$	
		$= p(1) = 4C_1(0.2)^1(0.8)^{4-1}$	1
		$= 0.4096$	½
		(2) $p(\text{at the most two are defective.})$	
		$= p(0) + p(1) + p(2)$	
		$= 4C_0(0.2)^0(0.8)^{4-0} + 4C_1(0.2)^1(0.8)^{4-1} + 4C_2(0.2)^2(0.8)^{4-2}$	1
		$= 0.9728$	½
	b)	A company manufacture electric motors. The probability that an elecric motor is defective is 0.01.What is the probability that a sample of 300 electric motors will contain exactly 5 defective motors? (Given: $e^{-3} = 0.0498$)	**06**
	Ans	$p = 0.01, n = 300$, $r = 5$	
		$\therefore m = np = 0.01 \times 300 = 3$	2
		$p(r) = \dfrac{e^{-m} \cdot (m)^r}{r!}$	
		$p(5) = \dfrac{e^{-3} \cdot (3)^5}{5!}$	2
		$p(5) = \dfrac{(0.0498) \cdot (3)^5}{5!}$	1
		=0.1008	1
	c)	In a sample of 1000 cases the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal,find	**06**
		(1) how many students score above 18?	
		(2) how many students score between 12 and 15?	
		$\left[\text{Given: A}(0.4) = 0.1554, \text{A}(0.8) = 0.2881, \text{A}(1.6) = 0.4452\right]$	
	Ans	Given $\bar{x} = 14$ $\sigma = 2.5$ $N = 1000$	
		(1) $z = \dfrac{x - \bar{x}}{\sigma} = \dfrac{18 - 14}{2.5} = 1.6$	1
		$\therefore p(\text{ score above 18}) = A(\text{greater than 1.6})$	
		$= 0.5 - A(1.6)$	
		$= 0.5 - 0.4452 = 0.0548$	1
		$\therefore \text{No.of students} = N \cdot p$	
		$= 1000 \times 0.0548 = 54.8$ *i.e.*, 55	1

SUMMER – 2018 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** Subject Code: 22206

Q. No.	Sub Q. N.	Answer	Marking Scheme
6.		(2) $z=\frac{x-\bar{x}}{\sigma}=\frac{12-14}{2.5}=-0.8$	1
		$z=\frac{x-\bar{x}}{\sigma}=\frac{15-14}{2.5}=0.4$	
		$\therefore\ p(\text{score between 12 and 15})=A(-0.8)+A(0.4)$	
		$=0.2881+0.1554$	
		$=0.4435$	1
		$\therefore \text{No. of students}=N\cdot p=1000\times 0.4435$	
		$=443.5\ \ i.e.,\ 444$	1

Important Note

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.
