

AANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

III SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2104]

REVISED CREDIT SYSTEM (16/11/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

✤ Missing data may be suitable assumed.

1A.	Expand the given function as Fourier series	
	$f(x) = x - x^2 \operatorname{in} (-\pi, \pi), \ f(x + 2\pi) = f(x)$	4
	Hence evaluate $\frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2} + \frac{1}{2} - \frac{1}{2} + \frac{1}{2} +$	-
	$1^2 2^2 3^2 4^2 \cdots$	
1B.	2% of the population have a blood disease in serious form, 10% have in mild form, 88% doesn't have it at all. A blood test is developed. The probability that the test is positive is 0.9 if the disease has the serious form, 0.6 if it is mild, 0.1 if no disease. A person has given the blood for testing and found to be positive. What is the probability that it has serious form?	3
1C.	Two persons A and B roll a pair of fair die alternatively. A wins if he gets the $sum = \{multiple \text{ of } 5\}$ before B gets $sum = \{multiple \text{ of } 6\}$. If A starts the game. What is the probability that A wins? Also, find the probability that B wins?	3
2A.	A random variable (X,Y) has the joint pdf given by	
	$f(x, y) = x + y, 0 \le x \le 1, 0 \le y \le 1$. Compute the correlation coefficient between	4
	X and Y.	
2B.	Find the Fourier transform of $f(x) = \begin{cases} 4 - x^2 & x < 2 \end{cases}$	3
	$0 \qquad else$	
2C.	Evaluate $\bigoplus_{s} \vec{F} \cdot d\vec{s}$ where $\vec{F} = 2xy\hat{i} + yz^{2}\hat{j} + xz\hat{k}$ and S is the surface of the	3
	region bounded by $x=0$, $y=0$, $y=3$, $z=0$ and $x+2z=6$	
3A.	Suppose that a 2D-random variable (X,Y) has the joint pdf given by	
	$f(x, y) = \begin{cases} x^2 + \frac{xy}{3} & 0 \le x \le 1, 0 \le y \le 2 \end{cases}$	
	0 otherwise	4
	i. Find the marginal pdf of X and Y	
	ii. Find $P(Y < X)$	
	iii. Find $P(Y < 0.5 X < 0.5)$	

Reg. No.



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3B.	Show that $\vec{F} = (y^2 \cos x + z^3)\hat{i} + (2y \sin x - 4)\hat{j} + (3xz^2 + 2)\hat{k}$ is conservative vector field. Find the scalar potential. Also find the work done in moving an object in the field from the point $(0, 1, 1)$ to $(0, 2, 2)$.	3
3C	Find the solution of the partial differential equation $u_{xx} + 2u_{xy} + u_{yy} = 0$ using the transformations $v = x$ and $z = x - y$.	3
4A.	State Greens theorem. Hence evaluate the line integral $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined $y = \sqrt{x}$ and $y = x^2$	4
4B.	Find the values of the constants <i>a</i> , <i>b</i> and <i>c</i> such that the directional derivative of $\phi = axy^2 + byz + cz^2x^3$ at (1,2,-1) has the maximum magnitude of 64 in a direction parallel to z axis.	3
4C.	Find the angle between the surfaces $z = x^2 + y^2$ and $z = (x - \frac{\sqrt{6}}{6})^2 + (y - \frac{\sqrt{6}}{6})^2$ at the point $(\frac{\sqrt{6}}{12}, \frac{\sqrt{6}}{12}, \frac{1}{12})$.	3
5A.	With suitable assumptions, derive one dimensional wave equation.	4
5B.	Solve $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial y} + u$, $u(x,0) = 6e^{-3x}$ by the method of separation of variables.	3
5C.	Obtain the half range cosine series expansion of $f(x) = \sin(\frac{\pi x}{l}), \ 0 < x < l$	3