Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (ECE/EEE/EI/BME)

MAKE-UP END SEMESTER EXAMINATIONS, December 2019

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2152]

REVISED CREDIT SYSTEM

Time: 3 Hours   Date:23-12-2019   MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A.	Obtain the Fourier series expansion of the function $f(x)=\begin{cases}-\pi, & -\pi<x<0\\ x, & 0<x<\pi\end{cases}$, $f(x+2\pi)=f(x)$ for all x and hence deduce the value of $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+\ldots$	**4**
1B.	Find the half range Fourier cosine series of $f(x)=x(2-x), \quad 0<x<2$.	**3**
1C.	Find the Fourier cosine transform of e^{-x} and hence find the sine transform of $\frac{x}{1+x^2}$	**3**
2A.	Find the Fourier transform of $f(x)=\begin{cases}a^2-x^2, & \lvert x\rvert\le a\\ 0, & \lvert x\rvert>a\end{cases}$. Hence evaluate $\int_0^\infty \frac{(\sin t-t\cos t)^2}{t^6}dt$	**4**
2B.	Find the analytic function f(z) = u+iv for which $u-v=e^x(\cos y-\sin y)$	**3**
2C.	If f(z) = u+iv is an analytic function, prove that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^2=4\lvert f'(z)\rvert^2$.	**3**

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3A.	Find all possible expansion of $\frac{z+2}{z^2-3z+2}$ about z = 0	**4**
3B.	Evaluate $\oint_C \frac{z^3}{(z-1)^2(z^2+4z+3)}dz$ where $C: \lvert z \rvert = 4$	**3**
3C.	Evaluate $\oint_C (xy+y^2)dx + x^2dy$ around the boundary of the region defined by y = x and y = x^2 using Green's theorem.	**3**
4A.	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, find its scalar potential and work done in moving an object in this field from (0,1,-1) to $\left(\frac{\pi}{2}, -1, 2\right)$.	**4**
4B.	Find the directional derivative of $\varphi(x,y,z) = xye^{x^2+z^2-5}$ at the point (1, 3, -2) in the direction 3i – j+ 4k.	**3**
4C.	Evaluate $\oiint_S \vec{F}.\hat{n}dS$ where $\vec{F} = 2xyi + yz^2j + xzk$ and S is the surface of the region bounded by x=0, x=2, y=0, y=2, z=0, z=2 using Divergence theorem.	**3**
5A.	Verify Stoke's theorem for $\vec{A} = (2x-y)i - yz^2j - y^2zk$ where S is the upper half surface of the sphere $x^2+y^2+z^2=1$ and C is its boundary.	**4**
5B.	Solve: $U_{xx} - 4U_{xy} + 3U_{yy} = 0$ using the transformation $v = x + y, z = 3x + y$.	**3**
5C.	Assuming the most general solution, solve the one dimensional heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ in a laterally insulated bar of length 10 cms whose ends are kept at zero and the initial temperature is given by $f(x) = \begin{cases} x, & 0 \le x \le 5 \\ 10-x, & 5 \le x \le 10 \end{cases}$	**3**