Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER MAKE-UP EXAMINATIONS, December 2018

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2102]

REVISED CREDIT SYSTEM

Time: 3 Hours　　Date: 24-12-2018　　MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A.	Obtain the Fourier series for the function $f(x)=\begin{cases}1+\frac{4x}{3}, & -\frac{3}{2}<x<0\\ 1-\frac{4x}{3}, & 0<x<\frac{3}{2}\end{cases}$ and $f(x+3)=f(x)$ for all x and hence deduce the value of $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\cdots$.	**4**
1B.	Find the half range Fourier cosine series of $f(x)=x(\pi-x), \quad 0<x<\pi$.	**3**
1C.	Find $F_C\{e^{-ax}\}$ and hence evaluate $F_C\left(\frac{1}{1+x^2}\right)$	**3**
2A.	Find the Fourier transform of $f(x)=\begin{cases}1-\lvert x\rvert, & \lvert x\rvert\le 1\\ 0, & \lvert x\rvert>1\end{cases}$. Hence evaluate $\int_0^\infty\left(\frac{\sin x}{x}\right)^2 dx$	**4**
2B.	If f(z) = u + iv is an analytic function of z then 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**
2C.	Find the analytic function f(z) = u + iv if $u=\frac{2\cos x\ .\cosh 2y}{\cos 2x+\cosh 2y}$	**3**
3A.	Find all possible expansion of $\frac{z^2-1}{z^2+5z+6}$ about z = 1	**4**
3B.	Evaluate $\oint_C \frac{z^3}{(z-1)^2(z^2-5z+6)}dz$ where $C:\lvert z\rvert=\frac{5}{2}$	**3**

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3C.	Evaluate $\oint_C \left(x^2-2xy\right)dx+\left(x^2y+3\right)dy$ around the boundary of the region defined by $y^2 = 8x$ and $x = 2$.	**3**
4A.	Prove that $\vec{F}=\left(2xy+z^3\right)\hat{i}+x^2\hat{j}+3xz^2\hat{k}$ is a conservative force field. Find the scalar potential for $\vec{F}$ and the work done in moving an object in this field from (1,-2,1) to $(3,1,4)$.	**4**
4B.	Find the value of a, b, c so that the directional derivative of $\varphi = axy^2+byz+cz^2x^3$ has a maximum of magnitude 64 in the direction of z-axis.	**3**
4C.	If $\vec{r}=xi+yj+zk$ and $r=\lvert\vec{r}\rvert$, prove that for differentiable function f(r) show that $\nabla^2 f(r)=\frac{d^2f}{dr^2}+\frac{2}{r}\frac{df}{dr}$ and hence find f(r) such that $\nabla^2 f(r)=0$.	**3**
5A.	Verify divergence theorem for $\iint_S \vec{F}.\,n\,ds$ where $\vec{F}=2xyi+yz^2j+xzk$ and S is surface of the parallelepiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1 and z = 3.	**4**
5B.	Solve: $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial x\partial y}-2\frac{\partial^2 u}{\partial y^2}=0$ using the transformations $v=x+y, z=2x-y$	**3**
5C.	Under suitable assumptions derive one dimensional wave equation.	**3**