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Reg No.										

B. E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, November 2013

CIVIL Engineering
(Common to Geo-inf,, Printing, EEE, ECE, Agri & Irr. Engg., Bio-Medical Engg., Ceramic and E&I Engg.)

THIRD SEMESTER

MA 8357 Transform Techniques and Partial Differential Equations.
(REGULATION 2012)

Time: 3 Hours. Answer All questions **Max. Mark: 100**

PART A (10 X 2 = 20 Marks)

1. Find the complete integral of $p+2q-5=0$.
2. Classify the given PDE: $3\frac{\partial^2 u}{\partial x^2}-5\frac{\partial^2 u}{\partial x\partial y}+4\frac{\partial^2 u}{\partial y^2}-2\frac{\partial u}{\partial x}+\frac{\partial u}{\partial x}-u=x^2$.
3. In the Fourier series expansion of $f(x)=\left(4x-2x^3\right)$ in $(-3,\ 3)$, what is the value of a_3?
4. Find the root mean square value of $f(x)=3-x^2$ in the interval $(0,\ 5)$.
5. A square metal plate of side a is bounded by the lines $x=0, x=a,\ y=0,\ y=a$. The edges represented by the lines $x=a$ and $y=a$ are insulated. The edge $x=0$ is kept at a temperature $0^\circ C$ and the edge $y=0$ at a temperature $T^\circ C$. State the differential equation which describes the steady state temperature distribution on the plate and conditions related to this problem.
6. A rod AB of length 10 cm has the ends A and B kept at temperature $20^\circ C$ and $120^\circ C$, respectively. Find the steady state temperature distribution on the rod.
7. State Fourier integral theorem.
8. State parseval's identity for Fourier cosine transform.
9. State final value theorem in Z-transform .
10. Obtain a difference equation by eliminating arbitrary constant from $y_n=a+(-4)^n$.

PART – B (5 X 16 = 80 Marks)

11. (i) Find the Fourier Transform of $f(x)$ given by $f(x)=\begin{cases} 2-|x| & for\,|x|<2 \\ 0 & for\,|x|>2 \end{cases}$. Hence show that $\int_0^{\infty}\left(\frac{\sin t}{t}\right)^4 dt=\frac{\pi}{3}$. **(8)**

(ii) Find the Fourier sine transform of $f(x)=e^{-ax}$, $a>0$ and hence evaluate $\int_0^{\infty}\frac{x^2}{(x^2+4)(x^2+9)}dx$. **(8)**

12. a)(i) Form the partial differential equation by eliminating the arbitrary functions from $z=f(x-2y)+g(3x+y)$. **(8)**

(ii) Solve: $\left(D^2-D'^2+5D-D'+6\right)z=3e^{2x-y}+4y-5$. **(8)**

OR

b)(i) Find the integral surface of $xp-yq=z$ which passes through the curve $x^2+y^2=1,\ z=1$. **(8)**

(ii) Solve: $\left(D^2-DD'-6D'^2\right)z = e^{3x+y}+\sin(2x+y)$. **(8)**

13. a)(i) Obtain the half range cosine series for the function $f(x)=x$ in the interval $0<x<2$. Hence find the sum of the series

$$1+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+--- \quad \text{and} \quad \frac{1}{1^4}+\frac{1}{3^4}+\frac{1}{5^4}+\frac{1}{7^4}+---.$$ **(10)**

(ii) Find the complex form of the Fourier series of the function $f(x)=e^{-x}$ when $-1<x<1$ and $f(x+2)=f(x)$. **(6)**

OR

b)(i) Find the Fourier series for $f(x)=x\cos x$ in the interval $0<x<2\pi$. **(8)**

(ii) Obtain a Fourier series upto the second harmonic from the data

x	0	$T/6$	$T/3$	$T/2$	$2T/3$	$5T/6$	T
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

(8)

14. a) A string is stretched tightly between $x = 0$ and $x = 20$ and is fastened at both ends. The midpoint of the string is taken to a height h and then released from rest in that position. Find the displacement of any point x of the string at any time t. **(16)**

OR

b) A rod of length 20 cm. long has its ends A and B kept at $30^\circ C$ and $110^\circ C$ respectively until the steady state is reached. At some time thereafter, the temperature at A is suddenly raised to $50^\circ C$ and at the same instant, that at B is lowered to $90^\circ C$ and the end temperatures are maintained. Find the temperature at a distance x from one end at time t. **(16)**

15.a)(i) Find the Z-transforms of $\{\sin n\theta\}$ and $\{\cos n\theta\}$. Hence find the Z-transforms of $\{n \sin n\theta\}$ and $\{a^n \cos n\theta\}$. **(8)**

(ii) Find the inverse Z-transform of $\dfrac{3z + 2z^2}{(z-3)^2(z+2)}$, using inversion integral method. **(8)**

OR

b)(i) Find the inverse Z-transform of $\dfrac{z^2}{(z-4)(z-3)}$, Using convolution theorem. **(4)**

(ii) If $Z[u_n] = \dfrac{3z^2 - 2z + 14}{(z-2)^2}$, find u_0 and u_1, using initial value theorem. **(4)**

(iii) Solve, by using Z-transform, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ given that $y_0 = y_1 = 0$. **(8)**

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