Seat No.	

S.E. (Electrical Engineering) (Semester - III) Examination, November - 2019
ENGINEERING MATHEMATICS - III
Sub. Code : 73212

Day and Date : Saturaday, 23 - 11 - 2019 **Total Marks : 70**
Time : 10.00 a.m. to 12.30 p.m.

Instructions :
1) **Attempt any three questions in each section.**
2) **Use of non-programmable calculator is allowed.**
3) **Figures to the right indicate full marks.**

SECTION - I

Q1) Answer the following.

a) Solve $\left(D^2-4D+4\right)y=e^{3x}\sin 2x$ **[5]**

b) Solve $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$ **[6]**

Q2) a) Find the directional derivative of $\phi=xy^2+yz^3$ at the point (2, –1, 1) in the direction of the vector $i+2j+2k$ **[6]**

b) $\nabla\left(\frac{\bar{a}\,.\,\bar{r}}{r^n}\right)=\frac{\bar{a}}{r^n}-\frac{n\left(\bar{a}\,.\,\bar{r}\right)}{r^{n+2}}\,\bar{r}$ **[5]**

Q3) a) Let the fuzzy sets A and B defined on the same universal set X by

$A(x)=\frac{x}{x+1}$ $B(x)=1-\frac{x}{10}$ $x\in\{0, 1, 2,.....10\}$

Find $A\cup\overline{B}$, $\overline{A}\cap B$, $\overline{A\cup B}$, $\overline{A\cap B}$ **[6]**

b) If fuzzy sets A and B are given by $A=\frac{0.3}{x_1}+\frac{0.9}{x_2}+\frac{0.7}{x_3}+\frac{0.6}{x_4}+\frac{0.1}{x_5}$ and

$B=\frac{0.2}{x_1}+\frac{0.4}{x_2}+\frac{0.5}{x_3}+\frac{0.7}{x_4}+\frac{0.9}{x_5}$ Find α-cut and strong α-cut of the fuzzy set $\overline{A}\cup B$ at $\alpha=0.5$ and 0.9. **[6]**

P.T.O.

Q4) Attempt any two.

a) An uncharged condensor of capacity C is charged by applying an e.m.f. of value E $\sin\left(\frac{t}{\sqrt{LC}}\right)$ through the leads of an inductance L and negligible resistance. The charge Q on the plate of the condenser satisfies the differential equation $\frac{d^2Q}{dt^2}+\frac{Q}{LC}=\frac{E}{L}\sin\left(\frac{t}{\sqrt{LC}}\right)$ prove that the charge at any time t is given by $Q=\frac{EC}{2}\left[\sin\left(\frac{t}{\sqrt{LC}}\right)-\left(\frac{t}{\sqrt{LC}}\right)\cos\left(\frac{t}{\sqrt{LC}}\right)\right]$ **[6]**

b) Show that the vector $\bar{f}=(x^2-yz)i+(y^2-xz)j+(z^2-xy)k$ is irrotational hence find the scalar potational ϕ **[6]**

c) Define **[6]**

i) Scalar cardinality

ii) α-cut

iii) Strong α-cut

give one example each

SECTION - II

Q5) a) Find the Fourier series for $f(x)=\begin{cases}\ell-x & 0<x<\ell\\ 0 & 0<x<2\ell\end{cases}$ **[7]**

b) Find half range Fourier cosine series of f(x) = x in (0,2) **[5]**

Q6) a) Find $L\left[\int_0^t u\sqrt{1-\sin u}\,du\right]$ **[5]**

b) Use convolution theorem to find $L^{-1}\left[\frac{1}{(s^2+4)(s^2+9)}\right]$ **[6]**

Q7) a) If 10% of bolts produced by a machine are defective then determine the probability that out of 10 bolts chosen at random **[5]**

i) one

ii) none

iii) at most 2 will be defective

b) In a certain factory producing cycles tyres, there is a small chance of one in 500 tyres to be defective. The tyres are supplied in lots of 10. Using Poissons Distribution, calculate the approximate number of lots containing no defective, one defective and two defectives tyres respectively in a consignment of 10,000 lots. **[6]**

Q8) Attempt any two.

a) Obtain Fourier series for $f(x)=a^2-x^2$ in (–a, a) **[6]**

b) Solve $(D^2+5D+6)y=40e^{2t}$ with $y(0)=0$, $y'(0)=2$ using Laplace Transform. **[6]**

c) The life time of a certain type of battery has mean life of 400 hours and standerd deviation 50 hours. Assuming the distribution of life time to be normal find the

i) The percentage of battery which have life time of more than 350 hrs.

ii) The percentage of battery which have life time between 300 and 500 hrs.

(given area under the normal curve fron z = 0 to z = 1 is 0.3413 and that between z = 0 and z = 0 is 0.4772) **[6]**

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