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Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **SH271U - Engineering Mathematics**

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Maximum Marks : **60**   Duration : **3 Hrs**

[Edit] [Print] [View Answer Key] [Close] **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. *All questions are compulsory.*
2. *Illustrate your answer with suitable figures/sketches wherever necessary.*
3. *Assume suitable additional data; if required.*
4. *Use of logarithmic table, drawing instruments and non programmable calculators is allowed.*
5. *Figures to the right indicate full marks.*

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1)   Solve all the questions

a) Solve by using method of variation of parameters   [5]
$$\left(D^2 - 4D + 4\right)y = \frac{e^{2x}}{x}$$

b) Solve $\left(x^3 D^3 + 2x^2 D^2\right)y = 10\left(x + \frac{1}{x}\right)$ [5]

c) Solve $\left(D^3 + 8\right)y = x^4 + 2x + 1$ [4]

2)   Solve any three questions

a) Obtain $L\left[e^{4t} \int_0^t t \, \sin 3t \, dt\right]$ [4]

b) Evaluate $\int_0^\infty e^{-2t} \, \sin^3 t \, dt$ [4]

c) Apply convolution theorem to evaluate $L^{-1}\left[\frac{1}{\left(s^2+a^2\right)^2}\right]$ [4]

d) Using Laplace Transform, solve $y'' + 2y' + y = t \, e^{-t}$ given that $y(0) = 1$, $y'(0) = -2$ [4]

3)   Solve any three questions

a) The first four moments of a distribution about the value 5 of the variable are 2,20,40 and 50. Find β_1 & β_2 [4]

b) In a sample of 100 cases ,the mean of a certain test is 14 and S.D. is 2.5, Assuming the distribution to be normal. Find how many score 16 ?   [4]

c) Find the best fitting regression equation of type $y = a \, x^b$ to the following data   [4]

x	1	2	3	4	5	6
y	2	16	54	128	250	432

d) Find the correlation coefficient for the following data   [4]

x	23	28	42	17	26	35	29	37	16	46
y	25	22	38	21	27	39	24	32	18	44

4)   Solve any three questions

a) Using invers sine transform, Find $f(x)$ if $F_s(\lambda) = \frac{e^{-a\lambda}}{\lambda}$ [4]

b) Find the Fourier cosine transform of $f(x) = \begin{cases} \cos x &, \ 0 < x < a \\ 0 &, \ x > a \end{cases}$ [4]

c) Use Green's theorem , to evaluate $\oint u \, dx + v \, dy$ for $\overline{F} = x^2 \, \overline{i} + xy \, \overline{j}$ over the region R enclosed by $y = x^2$ & $y = x$ [4]

d) Use Stoke's theorem, to evaluate $\int_s \int \left(\nabla \times \overline{F}\right) . \ d\overline{s}$ where $\overline{F} = \left(x^3 - y^3\right) \overline{i} - xyz \, \overline{j} + y^3 \, \overline{k}$ and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ [4]

5)   Solve any two questions

a) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ if   [5]
$(i) \ u(x,0) = 0$, $(ii) \ u(x, \, l) = 0$ $(iii) \ u(\infty, \, y) = 0$, $(iv) \ u(0, y) = u_0$

b) Solve $\frac{\partial u}{\partial t} = a^2 \, \frac{\partial^2 u}{\partial x^2}$ if   [5]
$(i) \ u(0,t) = 0$, $(ii) \ u(l, \, t) = 0$ $(iii) \ u(x,0) = x$, $0 < x < l$, $(iv) \ u(x,\infty) \, is \, finite$

c) Solve $\frac{\partial^2 y}{\partial t^2} = c^2 \, \frac{\partial^2 y}{\partial x^2}$ if   [5]
$(i) \ y(0,t) = 0$, $(ii) \ y(l, \, t) = 0$ $(iii) \left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$, $(iv) \ y(x,0) = k\left(lx - x^2\right)$, $for \ 0 < x < l$

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