Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

B. Tech. (CE/ME)

Winter – 2017

Course Code: SHU 301

Course Name: Engineering Mathematics III

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. **ATTEMPT ANY THREE.** **12**

a) Solve $\left(D^2+5D+6\right)y=e^{-2x}\sin 2x+4\,x^2e^x$.

b) Using the method of variation of parameter solve $\left(D^2+4\right)y=4\sec^2 2x$.

c) Solve by converting to Cauchy's Linear differential equation $\left[D^2-\left(2/x^2\right)\right]^2 y=0$.

d) Evaluate $\left(D^2-2D+4\right)^2 y=xe^x\cos\left(\sqrt{3}\,x+\alpha\right)$.

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2. **ATTEMPT ANY THREE.**

a) If $\overline{f}(s) = \left\{ \dfrac{1}{s\,(s+1)\,(s+2)\,(s+3)} \right\}$, find inverse Laplace transform of $\overline{f}(s)$.

b) State division property of Laplace transform and use it to find Laplace transform $\dfrac{d}{dt}\left\{\dfrac{\sin t}{t}\right\}$.

c) If s is sufficiently large, show using series expansion of $\tan^{-1}\{a/s\}$ that $L^{-1}\left[\tan^{-1}\{a/s\}\right] = \dfrac{\sin at}{t}$.

d) Find inverse Laplace transform of $\dfrac{1}{s}\log\left\{1+\dfrac{1}{s^2}\right\}$.

3. **Solve the following partial differential equations.**

a) $(x^2+y^2)(p^2+q^2)=1$.

b) $p-2q-(y+1)e^{3x}=0$.

c) $p\cos(x+y)+q\sin(x+y)=z$.

d) $(1-y^2)x\,q^2+y^2\,p=0$.

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4. **ATTEMPT ALL.** **12**

a) Calculate the coefficient of correlation for the following data

x	1	2	3	4	5	6	7	8	9
y	9	8	10	12	11	13	14	16	15

b) Obtain lines of regression for the following data :

x	1	2	3	4	5	6	7	8	9	10
y	10	12	16	28	25	36	41	49	40	50

c) Six dice are thrown 729 times. Use Binomial distribution to find how many times do you expect at least three dice to show a five or six.

5. **ATTEMPT ALL.** **12**

a) Given $y' = y^2 + xy$, $y(0) = 1$ find $y(0.1)$, $y(0.2)$ using Runge Kutta method.

b) Evaluate by means of Taylor's series expansion, the problem

$y'' - x(y')^2 + y^2 = 0$, $y(0) = 1$, $y'(0) = 0$ at x = 0.1, 0.2.

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c) Evaluate by using modified euler's method,

$y' = y - (2x/y)$, $y(0) = 1$ in the range $x = 0$ to 0.2.

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Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Third Semester B. Tech. (CE / ME)

Winter – 2016

Course Code: SHU301

Course Name: Engineering Mathematics III

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of normal distribution table, logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. ATTEMPT ANY THREE. **12**

a) Solve $(2x+1)^2\frac{d^2y}{dx^2} - 2(2x+1)\frac{dy}{dx} - 12y = 6x$.

b) Solve $\frac{d^2y}{dx^2} - y = e^{-x}\sin e^{-x} + \cos e^{-x}$

c) Solve $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = x^2\cos x$.

d) Solve the equation by method of variation of parameters

$$\frac{d^3y}{dx^3} + \frac{dy}{dx} = \operatorname{cosec} x.$$

2. ATTEMPT ANY THREE. **12**

a) Apply convolution theorem to evaluate $L^{-1}\left\{\frac{s}{(s^2-a^2)(s^2-b^2)}\right\}$

b) Find the Laplace transform of $\frac{1-\cos 2t}{t}$.

c) Find the inverse Laplace transform of $\frac{s}{(s^4+4a^4)}$

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d) Evaluate $\int_0^\infty t^3 e^{-t} \sin t \, dt$ by using Laplace transform.

3. **ATTEMPT ANY FOUR.**

a) $x^2 \frac{\partial z}{\partial x} + y^2 \frac{\partial z}{\partial y} = (x+y)z.$

b) $x^2p^2 + y^2q^2 = z^2.$

c) $\frac{1}{xy}\left(z - 2\sqrt{p+q}\right) = \frac{z}{y} + \frac{z}{x}.$

d) $z^2(p^2x^2 + q^2) = 1.$

e) Solve by using method of separation of variables th partial differential equation $\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial t} - u = 0$, if $u(x,0) = 6e^{-3x}$.

4. **ATTEMPT ALL.** 12

a) Use the fourth order Runge-Kutta method to find $u(0.2)$ of the initial value problem $u' = -2tu^2$, $u(0) = 1$, using $h = 0.2$.

b) Find the solution of $u(0.1)$ and $u(0.2)$ of the initial value problem $u' = x(1-2u^2)$, $u(0) = 1$, using the first three non zero terms of the Taylor's series method and $h = 0.1$.

c) Apply Gauss-Seidal method to solve the system of equations

$$6x + y + z = 105,$$
$$4x + 8y + 3z = 155,$$
$$5x + 4y - 10z = 65.$$

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5. **ATTEMPT ALL.** 12

a) Use least square method to fit second degree polynomial to the data:

x	-2	-1	0	1	2
y	15	1	1	3	19

b) Ten students got the following percentage of marks in Economics and Statistics

Roll No.	1	2	3	4	5	6	7	8	9	10
Marks in Economics	78	36	98	25	75	82	90	62	65	39
Marks in Statistics	84	51	91	60	68	62	86	58	53	47

Calculate the coefficient of correlation.

c) In a Poisson distribution if $p(r=1) = 2p(r=2)$. Find $p(r=3)$.

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Government College of Engineering, Amravati

(An Autonomous Institute of Government of Maharashtra)

Third Semester B. Tech. (Civil / Mechanical)

Winter - 2015

ourse Code: SHU301

ourse Name: Engineering Mathematics-III

ime: 2 Hrs. 30 Min **Max. Marks: 60**

istructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1 Attempt any THREE **12**

A Solve $(D^2 - 2D + 4)^2 y = xe^x \cos(\sqrt{3x} + \alpha)$

B Using the method of variation of parameters Solve $(D^2 + 2D + 1)y = 4e^{-x} \log x$

C Solve $\left(\dfrac{d^2}{dx^2} - \dfrac{2}{x^2}\right)^2 y = 0$

D Solve $(D^2 + 9)y = \sec 3x$

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2 Attempt any THREE **12**

A Solve $\frac{y-z}{yz}p+\frac{z-x}{zx}q=\frac{x-y}{xy}$

B Solve $\left(p^2+q^2\right)=\left(x^2+y^2\right)^{-1}$

C Solve $(x+y)(p+q)^2+(x-y)(p-q)^2=1$

D Use least- squares method to fit a curve of the form $y=ae^{bx}$ to the data

x	1	2	3	4	5	6
y	7.209	5.265	3.846	2.809	2.052	1.499

3 Attempt any THREE **12**

A Find inverse Laplace transform of $\frac{1}{s^3+a^3}$

B Prove that $L\left\{t^n\right\}=\frac{n!}{s^{n+1}}$

C If $L\{f(t)\}=\overline{f(s)}$ then show that

$$L\{t^n f(t)\}=(-1)^n\frac{d^n}{ds^n}\overline{f(s)}$$

D Show that

$$L^{-1}\left\{\frac{1}{s}\cos\frac{1}{s}\right\}=1-\frac{t^2}{(2!)^2}+\frac{t^4}{(4!)^2}-\frac{t^6}{(6!)^2}$$

4 Attempt any THREE **12**

A Solve by Gauss-Seidal Method
$x+7y-3z=-22,\ 5x-2y+3z=18,\ 2x-y+6z=22$

B Apply Runge-Kutta method to find an approximate value of y

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when x = 0.2 given that $\frac{dy}{dx} = x + y^2$,and y = 1 when x = 0

Using Taylor's series method obtain the solution of $\frac{dy}{dx} = 3x + y^2$ and y = 1 when x = 0 Find the value of y for x = 0.1 correct to four places of decimals.

If there are 3 misprints in book of 1000 pages find the probability that a given page will contain (i) no misprint (ii) more than 2 misprint

ttempt the following **12**

If θ be the acute angle between the two regression lines in the case of two variables x and y, show that

$$\tan\theta = \frac{1-r^2}{r}\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}$$ where r, σ_x, σ_y have their usual meaning . Explain the significance where r = 0 and $r = \pm 1$

3 Using the method of separation of variable , Solve

$$u_{xx} = u_y + 2u \ , \ u(0,y) = 0$$

$$\frac{\partial}{\partial x}u(0,y) = 1 + e^{-3y}$$

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Government College of Engineering, Amravati

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Third Semester B. Tech. (CE / ME)

Winter – 2013

Course Code: SHU301

Course Name: Engineering Mathematics – III

Time: 2 Hrs. 30 Min. **Max. Marks: 60**

Instructions to Candidate

1) All questions are compulsory.
2) Assume suitable data wherever necessary and clearly state the assumptions made.
3) Diagrams/sketches should be given wherever necessary.
4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
5) Figures to the right indicate full marks.

1. **Attempt any three:** **12**

(a) Solve $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y = \log x.\sin(\log x)$

(b) Solve $(x^2-y^2-z^2)p+2xyq = 2xz$

(c) Solve, by the method of variation of parameters,

$y''-2y'+y=e^x\log x$

(d) Solve $\frac{d^4y}{dx^4}+m^4y=0$

$\frac{1}{x}$ $\frac{x^2}{2}$

$-\frac{1}{2}x$ $\frac{x^2}{2}$

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2. **Attempt any three** 12

(a) Solve $\left(D^4 + 2D^2 + 1\right)y = x^2 \cos x$.

(b) Use suitable method to solve $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$, given that $u = 3e^{-y}$ when $x = 0$

(c) Solve $\left(2D^2 - 5DD' + 2D'^2\right)z = 5\sin(2x + y)$

(d) Solve $z^2(p^2 + q^2 + 1) = a^2$

3. **Attempt any three** 12

(a) State and prove Convolution property for Laplace transform.

(b) Solve $\frac{dy}{dx} = x + y$ *with* $x_0 = 0, y_0 = 1$ by Euler's modified formula for $x = 0.1$ by taking $h = 0.05$

(c) Use Runge Kutta method to find approximate value of y for $x = 0.2$ when $\frac{dy}{dx} = xy + y^2$ given $y(0) = 1,\ h = 0.1$.

(d) Employ Taylor's method to obtain approximate value of y at $x = 0.2$ for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$. Compare the numerical solution obtained with exact solution.

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4. Attempt any three 12

(a) Solve $\left(x^2 - yz\right) p + \left(y^2 - zx\right)q = z^2 - xy$.

(b) Apply Gauss-Seidal method to solve the following system of equations:

$2x - 3y + 20z = 25$;

$20x + y - 2z = 17$;

$3x + 20y - z = -18$

(c) Find Laplace transform of $\dfrac{e^{-at} - e^{-bt}}{t}$ hence

evaluate $\displaystyle\int_0^\infty \frac{e^{-at} - e^{-bt}}{t} dt$

(d) Find $L^{-1}\left\{\dfrac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}\right\}$

5. Attempt the following: 12

(a) Fit a second degree parabola to the following data:

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(b) The probability that a pen manufactured by a company will be defective is 1/10.If 12 such pens are manufactured find the probability that

i) exactly two pens will be defective
ii) at least two pens will be defective
iii) none will be defective.

(c) Fit a normal curve to the following data

class	1-3	3-5	5-7	7-9	9-11
frequency	1	4	6	4	1

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