NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: II - CARRY OVER THEORY EXAMINATION (20... - 20...)
Subject: Mathematical Foundations – II

Time: 3 Hours   Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A   20

1. Attempt all parts:-

1-a.   Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 \, dy \, dx$ (CO1,K2)   1

(a)   (a) $\frac{\pi}{16}$

(b)   (b) $\frac{\pi}{8}$

(c)   (c) 0

(d)   (d) None of these

1-b.   Integral value of $\int_0^\infty x^2 e^{-x} \, dx$ (CO1.K2)   1

(a)   -1

(b)   1

(c)   2

(d)   None of these

1-c.   The solution of the differential equation $(D^5 - D^3)y = 0$ will be   (CO2,K2)   1

(a) $y = (c_1 + c_2 x + c_3 x^2)e^x + c_4 e^x + c_5 e^{-x}$

(b) $y = (c_1 + c_2 x + c_3 x^2)e^{-x} + c_4 e^x + c_5 e^{-x}$

(c) $y = c_1 + c_2 x + c_3 x^2 + c_4 e^x + c_5 e^{-x}$

(d)   None of these

1-d.   Find the Particular Integral of $(D^2-1)y=x^2$ (CO 2, K2)   1

(a) $-(x^2+2)$

(b) $-x^2$

(c) $(x+2)$

(d) (x^2+2)

1-e.   Which of the following is the correct partial differential equation of the relation   1
$z=ax+by+ab$, where $'a'$ and $'b'$ are constants.   (CO3.K2)

(a) $z=px-qy+pq$

(b) $z=px+qy+ab$

(c) $z=px+qy+pq$

(d) $z=px+qy-pq$

1-f.   The Complementary function of partial differential equation   1
$D^2D'^2(D+D')z=0$ is   (CO3, K3)

(a) $C.F.=f_1(y)+xf_2(y)+f_3(x)+f_4(y)+f_5(y-x)$

(b) $C.F.=f_1(x)+yf_2(x)+f_3(x)+f_4(y)+f_5(y+x)$

(c) $C.F.=f_1(y)+xf_2(y)+f_3(x)+yf_4(x)+f_5(y+x)$

(d) $f_1(y)+xf_2(y)+f_3(x)+yf_4(x)+f_5(y-x)$

1-g.   Laplace transform of $f(t)=7e^{-2t}$ is   (CO 4, K2)   1

(a) $\dfrac{7}{s-2}$

(b) $\dfrac{1}{s+2}$

(c) $\dfrac{7}{s+2}$

(d) $\dfrac{1}{s-2}$

1-h.   If n > -1 then Laplace Transform of t^n is   (CO4, K2)   1

(a) $\dfrac{1}{s^n}$

(b) $\dfrac{1}{s^{n+1}}$

(c) $\dfrac{n}{s^{n+1}}$

(d)   none of these

1-i.   The ratio of present ages of Sri and Gowtham is 3: 4. Mahesh is 6 years older than   1
Sri and two years younger than Gowtham. The sum of the present ages of Sri and
Mahesh is   (CO5,K2)

(a)   48 years

(b)   50 years

(c)   52 years

(d)   54 years

1-j.   A person starts towards South direction. Which of the following order of direction   1
will lead him to East direction? (CO5,K2)

(a)   Right, Right, Right

(b)   Left, Left, Left

(c)   Left, Right, Right

(d)   Right, Left, Right

2. Attempt all parts:-

2.a.   Integral Value of $\int_0^5 \int_{2-x}^{2+x} dy\,dx$.   (CO1,K2)   2

2.b.   Find the complementary function of the second order linear differential equation   2
$x^2 y'' + xy' + y = \log x^2$ (CO 2,K3)

2.c.   Solve the partial differential equation $DD'(D + 2D' + 1)z = 0$. .   (CO3.K3)   2

2.d.   Find the inverse Laplace transform of the function $f(s) = \dfrac{1}{\sqrt{s+a}}$.   (CO   2
4,K2)

2.e.   In what time does a sum of money become four times at simple interest rate of 5%   2
per annum? (CO5,K2)

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.   Evaluate the integral by changing the order of integration $\int_0^a \int_{x^2/a}^{2a-x} xy\,dydx$.   6
(CO1,K2)

3-b.   Find by the double integration area of the region enclosed by the curves $x^2 + y^2 = a^2$, $x + y = a$ in the first quadrant.   (CO1,K3)   6

3-c.   Solve the differential equation $xy'' - y' + (1-x)y = x^2 e^{-x}$, given that $y = e^x$ is a   6
part of CF.   (CO 2,K3)

3-d.   Solve the differential equation $(D^4 - 1)y = \cos x \cosh x$.   (CO 2,K2)   6

3.e.   Solve the linear partial differential equation $4r - 4s + t = 16 \log(x + 2y)$.   (CO3.K3)   6

3.f.   Evaluate the value of the integral $\int_0^\infty \dfrac{e^{-t} \sin t}{t} dt$.   (CO 4,K3)   6

3.g.   (i) A girl leaves from her home. She first walks 30 m in North-West direction and   6
then 30 m in

South-West direction. Next, she walks 30 m in South-East direction. Finally,
she turns

towards her house. In which direction is she moving?

(ii) Kashish goes 30m North, then turns right and walks 40 m, then again turns right and walks 20 m, then again turns right and walks 40 m. How far is he from his original position? (CO5,K2)

SECTION-C 50

4. Answer any <u>one</u> of the following:-

4-a. Change the order of integration for $I = \int_0^1 \int_{x^2}^{2-x} xy \, dy \, dx$ and evaluate the same. (CO1,K3) 10

4-b. Change into polar co-ordinates and hence evaluate the integral $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} \, dy \, dx$. (CO1,K3) 10

5. Answer any <u>one</u> of the following:-

5-a. Solve the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 4y = e^x \, Cos \, x + Sin \, x \, Cos \, 3x$. (CO 2,K3) 10

5-b. Solve the following differential equation by changing the independent variable $\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + 4x^2y = x^4$. (CO 2,K3) 10

6. Answer any <u>one</u> of the following:-

6-a. Solve the linear partial differential equation $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6\frac{\partial^2 z}{\partial y^2} = y \cos(x)$. 10 (CO3,

6-b. Solve : $(D^2 - D'^2 - 3D + 3D')z = xy + e^{x+2y}$. (CO3,K3) 10

7. Answer any <u>one</u> of the following:-

7-a. Apply convolution theorem to evaluate: $L^{-1}\left[\frac{s}{(s^2+4)^2}\right]$. (CO4,K3) 10

7-b. Solve the following differential equation by Laplace transform $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t$, Given that $x = 0, \frac{dx}{dt} = 1$ at $t = 0$. (CO 4,K4) 10

8. Answer any <u>one</u> of the following:-

8-a. (i) Compound interest on a sum of money for 2 years at 4 per cent per annum is Rs.2448. Find the simple interest of the same sum of money at the same rate of interest for 2 years? 10

(ii) The simple interest on a sum of money at 4% per annum for 2 years is 80. Find the compound interest in the same sum for the same period? (CO5,K2)

8-b. (i) If P's father Q is paternal uncle of B and A's husband M is paternal uncle of P, then how is A related to B? 10
(ii) Pointing to a woman in a photograph a man says: "She is the only daughter of my father's mother-in-law". How is the woman related to the man?
(iii) Three men are going somewhere. If two of them are fathers and two of them are sons then how is the eldest man related to the youngest man? (CO5,K2)

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