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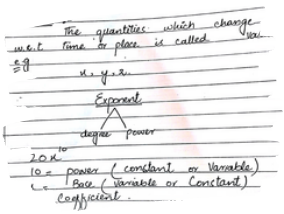
PARTIAL DIFFERENTIAL EQUATION

PASTPAPERS

7th & 8th SEMESTER

5 Years
PASTPAPERS



COMPOSE BY:
MUHIBB ALI

Distance Learning Education

GC UNIVERSITY, FAISALABAD

Class: M.Sc semester 3rd Course Titles: P.D.Es Course Code:-DMTH-656

Subject: Mathematics Student's Name: Rana M. Adnan Roll No. 173044

Time Allowed: 2:30 hours Max Marks: 80

SUBJECTIVE PART

Note: Attempt any four questions. Each question carries equal marks. ($4 \times 20 = 80$)

Q.No.2.a. Solve the P.D.E $\Phi_{tt} = \Phi_{xx}$ subject to the conditions

$$\Phi(0,t) = p, \quad \Phi(L,t) = q \quad \& \quad \Phi(x,0) = f(x), \quad \Phi_t(x,0) = g(x)$$

b. Solve $U_{xx} + U_{yy} = U_t$ subject to conditions

$$U(0,y,t) = 0 = U(a,y,t) \quad , \quad U(x,0,t) = 0 = U(x,b,t) \quad \& \quad U(x,y,0) = f(x,y)$$

Q.No.3.a. Classify the equation: $\sin^2 x\varphi_{xx} + \sin 2x\varphi_{xy} + \cos^2 x\varphi_{yy} = x$, $x > 0, y > 0$ and determine its canonical form.

b. Discuss canonical transformation for Second order P.D.E. Also prove that this transformation obeys the relation $\Delta^* = |J|^2 \Delta$ where $\Delta = b^2 - 4ac$, $\Delta^* = B^2 - 4AC$

Q.No.4.a. Solve: $\frac{\partial \varphi}{\partial t} + \frac{\partial \varphi}{\partial x} + \varphi = 0$ subject to $\varphi(x,0) = Sinx$, $\varphi(0,t) = 0$ by the Laplace transform method.

b. Find the region in which equation is Hyperbolic &determine a change of variable that reduces the equation $U_{xx} - yU_{yy} = 0$ into canonical form.

Q.No.5.a. Solve $\varphi_{xx}(x,t) - \varphi_t(x,t) = 0$ with $\varphi(x,0) = e^{-x^2}$ and $\left\{\begin{matrix}\varphi(x,t) = 0 \text{ as } x \to \pm\infty \\ \varphi_x(x,t) = 0 \text{ as } x \to \pm\infty\end{matrix}\right\}$ by Fourier Transformation.

b. Evaluate the Fourier transform of $f(x) = e^{-ax} \sin bx$ Also find $\Im[f^3(x)]$

Q.No.6.a. Solve by Laplace Transformation $\varphi_{xx}(x,t) = a^2 \varphi_t(x,t) - g$ subject to conditions

$\varphi(0,t) = 0$, $\lim_{x \to \infty} \varphi_x(x,t) = 0$ and $\varphi(x,0) = \varphi_t(x,0) = 0$

b. Determine $\Im_c[e^{-t} \cos x]$

Q.No.7.a. Derive Wave Equation.

b. Find Solution of P.D.E by Variable Separation $x^3\varphi_{xxx} + 3x^2\varphi_{xx} + x\varphi_x + \varphi_{yy} = 0$

BEST OF LUCK

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Department of Mathematics, Government College University, Faisalabad

BS(H) 8th Semester — Final Term Spring 2019

Course Title: Partial Differential Equations — Course Code: MTH-620

Time Allowed: 1:30 Hr — Marks: 24

Q 2: Solve the initial-value problem by the method of Fourier transforms:

$$\begin{aligned} \frac{\partial^2 u}{\partial t^2} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0), \\ u(x,0) &= 0, \quad (-\infty < x < \infty), \\ u_t(x,0) &= g(x), \quad (-\infty < x < \infty) \end{aligned}$$

Q 3: Find the complex Fourier integral representation of

$$f(x) = e^{-a|x|}, \quad (-\infty < x < \infty, \quad a > 0)$$

Q 4: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\begin{aligned} \frac{\partial u}{\partial t} &= 4\frac{\partial^2 u}{\partial x^2}, \quad (0 < x < 3, \quad t > 0), \\ u(x,0) &= 10\sin(2\pi x) - 6\sin(4\pi x), \quad (0 < x < 3), \\ u(0,t) &= 0, \quad (t > 0), \\ u(3,t) &= 0, \quad (t > 0). \end{aligned}$$

$\frac{10}{s+16\pi^2} + \frac{2s}{s+64\pi^2}$

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Distance Learning Education

GC UNIVERSITY, FAISALABAD

Class: M.Sc semester 3rd Course Titles: P.D.Es Course Code:-DMTH-656

Subject: Mathematics Student's Name: Rana M. Adnan Roll No. 173044

Time Allowed: 2:30 hours Max Marks: 80

SUBJECTIVE PART

Note: Attempt any four questions. Each question carries equal marks. ($4 \times 20 = 80$)

Q.No.2.a. Solve the P.D.E $\Phi_{tt} = \Phi_{xx}$ subject to the conditions

$\Phi(0,t) = p$, $\Phi(l,t) = q$ & $\Phi(x,0) = f(x)$, $\Phi_t(x,0) = g(x)$

b. Solve $U_{xx} + U_{yy} = U_t$ subject to conditions

$U(0,y,t) = 0 = U(a,y,t)$, $U(x,0,t) = 0 = U(x,b,t)$ & $U(x,y,0) = f(x,y)$

Q.No.3.a. Classify the equation: $\sin^2 x\varphi_{xx} + \sin 2x\varphi_{xy} + \cos^2 x\varphi_{yy} = x$, $x > 0, y > 0$ and determine its canonical form.

b. Discuss canonical transformation for Second order P.D.E. Also prove that this transformation obeys the relation $\Delta^* = |J|^2 \Delta$ where $\Delta = b^2 - 4ac$, $\Delta^* = B^2 - 4AC$

Q.No.4.a. Solve: $\frac{\partial \varphi}{\partial t} + \frac{\partial \varphi}{\partial x} + \varphi = 0$ subject to $\varphi(x,0) = \sin x$, $\varphi(0,t) = 0$ by the Laplace transform method.

b. Find the region in which equation is Hyperbolic &determine a change of variable that reduces the equation $U_{xx} - yU_{yy} = 0$ into canonical form.

Q.No.5.a. Solve $\varphi_{xx}(x,t) - \varphi_t(x,t) = 0$ with $\varphi(x,0) = e^{-x^2}$ and $\begin{Bmatrix} \varphi(x,t) = 0 \text{ as } x \to \pm\infty \\ \varphi_x(x,t) = 0 \text{ as } x \to \pm\infty \end{Bmatrix}$ by Fourier Transformation.

b. Evaluate the Fourier transform of $f(x) = e^{-x^2} \sin bx$ Also find $\Im[f'(x)]$

Q.No.6.a. Solve by Laplace Transformation $\varphi_{tt}(x,t) = a^2 \varphi_x(x,t) - g$ subject to conditions

$\varphi(0,t) = 0$, $\lim_{x \to \infty} \varphi_x(x,t) = 0$ and $\varphi(x,0) = \varphi_t(x,0) = 0$

b. Determine $\Im_c[e^{-t} \cos x]$

Q.No.7.a. Derive Wave Equation.

b. Find Solution of P.D.E by Variable Separation $x^2\varphi_{xx} + 3x^2\varphi_x + x\varphi_t + \varphi_{yy} = 0$

BEST OF LUCK

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Distance Learning Education

GC UNIVERSITY, FAISALABAD

Class: M.Sc semester 3rd Course Titles: P.D.Es Course Code:-DMTH-656

Subject: Mathematics Student's Name: Rana M. Adnan Roll No. 173044

Time Allowed: 2:30 hours Max Marks: 80

SUBJECTIVE PART

Note: Attempt any four questions. Each question carries equal marks.

Q.No.2.a. Solve the P.D.E $\Phi_x = \Phi_{xx}$ subject to the conditions

$\Phi(0,t) = p$, $\Phi(1,t) = q$ & $\Phi(x,0) = f(x)$, $\Phi(x,\ldots) = \ldots(x)$

b. Solve $U_{xx} + U_{yy} = U_t$ subject to conditions

$U(0,y,t) = 0 = U(a,y,t)$, $U(x,0,t) = 0 = U(x,b,t)$ & $U(x,y,0) = \ldots(x,y)$

Q.No.3.a. Classify the equation: $\sin^2 x\varphi_{xx} + \sin 2x\varphi_{xy} + \cos^2 x\varphi_{yy} = x$, $x > 0, y > 0$ and determine its canonical form.

b. Discuss canonical transformation for Second ... Also prove that this transformation obeys the relation

$\Delta^* = |J|^2 \Delta$ where $\Delta = b^2 - 4ac$, $\Delta^* = \ldots$

Q.No.4.a. Solve: $\frac{\partial \varphi}{\partial t} + \frac{\partial \varphi}{\partial x} + \varphi = \ldots$ subject to $\varphi(x,0) = Sinx$, $\varphi(0,t) = 0$ by the Laplace transform method.

b. Find the region in which equation is Hyperbolic &determine a change of variable that reduces the equation ... $= 0$ into canonical form.

Q.No.5.a. Solve $\varphi_{xx}(x,t) - \varphi_t(x,t) = 0$ with $\varphi(x,0) = e^{-x^2}$ and $\begin{Bmatrix} \varphi(x,t) = 0 \text{ as } x \to \pm\infty \\ \varphi_x(x,t) = 0 \text{ as } x \to \pm\infty \end{Bmatrix}$ by Fourier Transformation.

b. Evaluate the Fourier transform of $f(x) = e^{-x^2} \sin bx$ Also find $\Im[f'(x)]$

Q.No.6.a. Solve by Laplace Transformation $\varphi_{tt}(x,t) - a^2\varphi_{xx}(x,t) = g$ subject to conditions

$\varphi(0,t) = 0$, $\lim_{x\to\infty} \varphi_x(x,t) = 0$ and $\varphi(x,0) = \varphi_t(x,0) = 0$

b. Determine $\Im_c[e^{-x}\cos x]$

Q.No.7.a. Derive Wave Equation.

b. Find Solution of P.D.E by Variable Separation $x^3\varphi_{xx} + 3x^2\varphi_{xx} + x\varphi_x + \varphi_{yy} = 0$

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Q.2 Convert IVP $\frac{d^n y}{dx^n} + a_1(x)\frac{d^{n-1}y}{dx^{n-1}} + a_2(x)\frac{d^{n-2}y}{dx^{n-2}} + \ldots + a_{n-1}(x)\frac{dy}{dx} + a_n(x)y = \varphi(x)$

with initial conditions $y(a) = q_0, y'(a) = q_1, y''(a) = q_2, \ldots, y^{(n-1)}(a) = q_{n-1}$ into integral equation. (7)

Q.3. Solve Volterra Integral Equation:

$$y(x) = 29 + 6x + \int_0^x [5 - 6(x-t)]y(t)dt \text{ under ICs: } g(x) = 0, \frac{g(x)}{dx} = 1.$$

M. Numan
Roll 6831 (6)

Q.4. Solve Symmetric Integral Equation: $y(x) = 1 + \lambda \int_0^x \cos(x+t)y(t)dt$ (6)

Q.5 State Liebniz rule of differentiation under Integral Sign. Prove the following formula

$$\int_a^x y(t)dt^n = \int_a^x \frac{(x-t)^{n-1}}{(n-1)!} y(t)dt^n$$ where LHS integration stands for n integrals w.r.t. t. (6)

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Roll No: 40070

Department of Mathematics, Government College University, Faisalabad

MSC 3rd Semester

Mid Term Fall 2018

Course Title: Partial Differential Equations

Course Code: MTH-653

Time Allowed: 01 hour

Marks: 18

SUBJECTIVE PART

Note: Attempt all questions.

Q. No. 1. Form the PDE by eliminating the arbitrary constants from the relation, $u = (x^2 + a)(y^2 + b)$. (2)

Q. No. 2. Form the PDE by eliminating the arbitrary functions from the relation, $u = f(\frac{y}{x})$. (2)

Q. No. 3. Solve the following PDE, $u_{xx} + 3u_x - 4u = 12$ (2)

Q. No. 4. Classify the following PDEs. (a) $u_{xx} + 3u_{xy} = 0$. (b) $u_{xx} = \frac{1}{a^2} u_{tt}$ (2+2)

Q. No. 5. Solve the two-dimensional heat equation in polar coordinates. (4)

Q. No. 6. Solve the two-dimensional wave equation along a finite string using Laplace Transform.

Note that the first initial condition is equal to $u(x, 0) = \sin\frac{\pi x}{L}$, $(0<X<L)$. (4)

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GOVERNMENT COLLEGE UNIVERSITY, FAISALABAD
External Semester Examination Fall 2019-20
MSc Mathematics (3rd Semester)

e Code: MTH-653
e Title: Partial Differential Equations
ctive Part:

Max. Marks: 48 (18 + 30)
Credit Hrs.: 3(3-0)
Time: 02:30 Hrs.

Attempt all five questions all question carry equal marks.

Q 2: Solve the initial-value problem by the method of Fourier transforms:

$$\begin{aligned} \frac{\partial^2 u}{\partial t^2} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0), \\ u(x,0) &= f(x), \quad (-\infty < x < \infty), \\ u_t(x,0) &= 0, \quad (-\infty < x < \infty). \end{aligned}$$

Q 3: Find the complex Fourier integral representation of

$$f(x) = e^{-a|x|}, \quad (-\infty < x < \infty, \quad a > 0).$$

Q 4: Reduce the equation $yu_{xx} + (x+y)u_{xy} + xu_{yy} = 0$ to a canonical form.

Q 5: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\begin{aligned} \frac{\partial u}{\partial t} &= 4\frac{\partial^2 u}{\partial x^2}, \quad (0 < x < 3, \quad t > 0), \\ u(x,0) &= 10\sin(2\pi x) - 6\sin(4\pi x), \quad (0 < x < 3), \\ u(0,t) &= 0, \quad (t > 0), \\ u(3,t) &= 0, \quad (t > 0). \end{aligned}$$

Q 6: Find the temperature distribution $\phi(x,y,t)$ in a thin rectangular plate of dimensions $0 \le x \le a$ and $0 \le y \le b$, if the edges are kept at zero temperature and the initial temperature in the plate is

$$\phi(x,y,0) = K\sin\frac{\pi x}{a}\sin\frac{\pi y}{b}.$$

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Government College University Faisalabad

Final Term Exams | **Course Code (MTH-656)** | **Total Marks: 30**

MS.c (Mathematics)-4th Semester | **Time 2hr** | **Partial Differential Equations**

Note: Solve all questions.

Q# 1. State and prove the convolution theorem? [5]

Q# 2. Prove the orthogonality property of Bessel's equation $x^2y'' + xy' + (\lambda^2 x^2 - n^2)y = 0$ [5]

Q#3.If the weighted function r(x) preserves the same sign in interval (a, b) then the eigenvalues of [5]

the periodic S.L system $d/dx[p(x)d/dx] + q(x)y + \lambda r(x)y = 0$, with periodic B.C $y(a)=y(b)$, $y'(a)=y'(b)$ are real

Q# 4. Use the method of Green's function to solve $t^2y'' - 6y = \log(t)$, $y(1) = 1/6$, $y'(1) = -1/6$ [5]

Q# 5. Solve $d^2y/dt^2 + 2t\, dy/dt - 4y = 1$, $y(0) = y'(0) = 0$ [5]

Q# 6. If $\mathcal{L} = D[p(x)D] + q(x)$, $D=d/dx$ is defined on interval [a, b] and u and v are any functions with continuous 2nd order derivatives on [a, b] then $u\,\mathcal{L}[v] - v\,\mathcal{L}[u] = d/dx[p(x)W(u,v)(x)]$, W is Wronskian function. [5]

Date 22-06-18

Best of Luck

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Department of Mathematics, Government College University, F

M.Sc 3rd Semester — Final Term Fall 20

Course Title: Integral Equations — Course Code: MTH

SUBJECTIVE PART — Time Allowed: 2.30 hrs

Note: **Attempt all five questions all question carry equal marks.**

Q. No. 2 Transform the initial value boundary value problem

$$y'' + y = 0, \quad y(0) = 1 = y(-1)$$

into Volterra integral equation

Q. No. 3 Solve the Fredholm integral equation by separable kernel method

$$g(s) = s + tans + \int_0^{\frac{\pi}{4}} sa(t)dt$$

Q. No. 4 Show that the integral equation

$$g(s) = f(s) + \frac{1}{\pi}\int_0^{2\pi} Sin(s+t)g(t)dt$$

Possesses no solution for $f(s) = s$, but it possesses infinitely many solutions when $f(s)$

Q. No. 5 Solve the integral equation

$$a(s) = Coshs + \int_0^s e^{s-t}g(t)dt$$

and evaluate the resolvent kernel

Q. No. 6 Find the Eigen values and corresponding Eigen functions of the homogeneous integral equa

$$\lambda a(s) = \int_0^{\pi} SinsSin2ta(t)dt$$

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Roll No. _____

Department of Mathematics, Government College University, Faisalabad

MSc 3rd Semester

Course Title: Partial Differential Equations

Final Term Fall 2016

Course Code: MTH

Time Allowed:

BJECTIVE PART

Attempt all five questions all question carry nine marks.

Q 2: State and prove convolution theorem in

Q 3: Solve the initial-value problem by the method of Laplace transforms:

Q 4: Reduce the equation

form.

Q 5: Solve the following

method of Laplace

where

Q

Solve the following boundary-value problem by the help of separation of variables method

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Dr. Naeem Nawaz

Q2. Show that under the general transformation, the type of PDE $a\varphi_{xx} + b\varphi_{xy} + c\varphi_{yy} + d\varphi_x + e\varphi_y + f\varphi = g(x, y)$ does not change. (5)

Q 3. Show that the equation: $e^x\varphi_{xx} - e^y\varphi_{yy} = 1$ is always hyperbolic and transform it into canonical form. (5)

Q 4. Solve: $\frac{\partial \varphi}{\partial t} - \frac{\partial^2 \varphi}{\partial x^2} = 0$ subject to IC: $\varphi(x,0) = 1 + \sin(\pi x)$ and BCs: $\varphi(0,t) = 1, \varphi(1,t) = 1$ by the method of Laplace transform. (5)

Q 5. Determine the Fourier Transform of $e^{-ax^2}\cos(cx)$ (5)

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Q 2: Solve the initial-value problem by the method of Fourier transforms:

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0),$$
$$u(x,0) = f(x), \quad (-\infty < x < \infty),$$
$$u_t(x,0) = 0, \quad (-\infty < x < \infty).$$

Q 3: Find the complex Fourier integral representation of

$$f(x) = e^{-a|x|}, \quad (-\infty < x < \infty, \quad a > 0).$$

Q 4: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\frac{\partial u}{\partial t} = 1 \frac{\partial^2 u}{\partial x^2}, \quad (0 < x < 3 \quad t > 0),$$
$$u(x,0) = 10\sin(2\pi x) - 6\sin(4\pi x), \quad (0 < x < 3),$$
$$u(0,t) = 0, \quad (t > 0),$$
$$u(3,t) = 0, \quad (t > 0).$$

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Roll No: ----------

Department of Mathematics, Government College University, Faisalabad

MSC 3rd Semester — Mid Term Fall 2018

Course Title Partial Differential Equations — Course Code: MTH-653

SUBJECTIVE PART — Time Allowed: 1Hour — Marks: 18

Note: Attempt all questions.

Q. No. 1. Form the PDE by eliminating the arbitrary constants from the relation, $u = (x^2 + a)(y^2 + b)$. (2)

Q. No. 2. Form the PDE by eliminating the arbitrary functions from the relation, $u = f(\frac{y}{x})$. (2)

Q. No. 3. Solve the following PDE, $u_{xx} + 3u_x - 4u = 12$ (2)

Q. No. 4. Classify the following PDEs. (a) [illegible] (2+2)

Q. No. 5. Solve the two-dimensional heat equation in polar coordinates. (4

Q. No. 6. Solve the two-dimensional wave equation along a finite string using Laplace Transform.

Note that the first initial condition is equal to $u(x, 0) = \sin\frac{\pi x}{L}$, $(0<X<L)$.

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Roll No. 11-3

Department of Mathematics, Government College University, Faisalabad
Final Term Fall 2017
MSc 1st
Course Title: Fluid Mechanics-I
Course Code: MTH-607
Time Allowed: 120 Minutes
Marks

SUBJECTIVE PART

Note: Attempt all questions. all question carry equal marks

- No 1: Derive acceleration components in cylindrical coordinates
- No 2: Find the equation of streamline and path line for $u = 1 - ty$, $v = 2 - ty$ passing through point (
- No 3: Derive Bernoulli's equation of motion for steady flow under conservative forces and discuss time t=0
- No 4: Define vortex tube and find strength of the vortex tube. special cases
- No 5: Discuss flow along a curve and find the relation between circulation and vorticity

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Question#1: Classify and reduce the following equation to a canonical-form and then solve it. **(8)**

$$3u_{xx} + 10u_{xy} + 3u_{yy} = 0$$

Question#2: (a) Find the Laplace transform of: **(4)**

$$f(t) = \frac{\cos 2t - \sin 3t}{t}$$

(b) Find the inverse Laplace transform of: **(4)**

$$\ln \frac{s-4}{4+s^2}$$

Question#3: Using convolution theorem, solve the following: **(4+**

(a) $L^{-1}\left[\frac{1}{s^2(s+1)^2}\right]$

(b) $L^{-1}\left[\frac{1}{s^2(s^2+a^2)}\right]$

Question#4: Find the solution of following partial differential equation: **(8)**

$$u_t(x,t) = u_{xx}(x,t)$$
$$0 < x < 2, \quad t > 2$$
$$u(0,t) = 0, \quad u(2,t) = 0,$$
$$u(x,0) = 3\sin(2\pi x)$$

Question#5: Find the solution of following partial differential equation using Laplace transform method: **(8)**

PDE: $u_t(x,t) = 3u_{xx}(x,t)$

BCs: $u\left(\frac{\pi}{2},t\right) = 0, \qquad u_x(0,t) = 0$

IC: $u(x,0) = 30\cos 5x$

Best of Luck

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Department of Mathematics, Government College University, Faisalabad

BS-VIII–M
Course Title: Partial Differential Equations

Mid Term Spring 2018
Course Code: MTH–620

Question#1: Find the canonical form of: **(8)**

$$x^2 u_{xx} - y^2 u_{yy} = 0$$

Question#2: Find the solution of following partial differential equation: **(8)**

$$u_t(x,t) = u_{xx}(x,t)$$
$$0 < x < 2, \ t > 2$$
$$u(0,t) = 0, \quad u(2,t) = 0,$$
$$u(x,0) = 3\sin(2\pi x)$$

Question#3: Find the solution of following partial differential equation by separation of variables: **(8)**

$$u_{tt}(x,t) = c^2 u_{xx}(x,t) + \sin(\pi x)$$
$$0 < x < 1, \ t > 0$$
$$u(0,t) = 0, \quad u(1,t) = 0,$$
$$u(x,0) = 0, \quad u_t(x,0) = 0$$

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Department of Mathematics, Government College University, Faisalabad

BS(H) 7th Semester — Mid Term Spring 2019

Course Title: Partial Differential Equations — Course Code: MTH-620

Time Allowed: 1 Hr — Marks: 18

Q 1: Solve the following boundary-value problem by the separation of variables method.

$$\begin{aligned}
\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2} &= 0, \quad 0<x<a, \quad 0<y<b,\\
\phi(0,y) &= 0, \quad 0<y<b,\\
\phi(a,y) &= 0, \quad 0<y<b,\\
\phi(x,0) &= 0, \quad 0<x<a,\\
\phi(x,b) &= f(x), \quad 0<x<a.
\end{aligned}$$

Q 2: Reduce the equation $u_{xx}+yu_{yy}=0,\ y>0$ to a canonical form.

Q 3: Solve the two-dimensional wave equation by the help of separation of variables method.

$$\frac{\partial^2 u}{\partial r^2}+\frac{1}{r}\frac{\partial u}{\partial r}+\frac{1}{r^2}\frac{\partial^2 u}{\partial\theta^2}=\frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}.$$

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Roll No: 40070

Department of Mathematics, Government College University, Faisalabad

MSC 3rd Semester

Mid Term Fall 2018

Course Title Partial Differential Equations

Course Code MTH-653

Time Allowed 1Hour

Marks 18

SUBJECTIVE PART

Note: **Attempt all questions.**

Q. No. 1. Form the PDE by eliminating the arbitrary constants from the relation, $u = (x^2 + a)(y^2 + b)$. (2)

Q. No. 2. Form the PDE by eliminating the arbitrary functions from the relation, $u = f(\frac{y}{x})$. (2)

Q. No. 3. Solve the following PDE, $u_{xx} + 3u_x - 4u = 12$ (2)

Q. No. 4. Classify the following PDEs. (a) $u_{xx} + 3u_{yy} = 0$, (b) $u_{xx} = \frac{1}{a^2} u_{tt}$ (2+2)

Q. No. 5. Solve the two-dimensional heat equation in polar coordinates. (4)

Q. No. 6. Solve the two-dimensional wave equation along a finite string using Laplace Transform.

Note that the first initial condition is equal to $u(x, 0) \quad \sin\frac{\pi x}{L}$, $(0<X<L)$. (4)

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Department of Mathematics GC University FSD
Mid Term Examination Spring Semester 2016
Class: MSc Course Title: Partial Differential Equations Course Code: MTH----
Time Allowed: 1:00 h Semester: VIII Session: 2014-16 (Morning)
Marks: 24 date

Q1. Solve PDE: $\phi_{xx} = \phi_{tt}$ with BCs and ICs are
$\phi(0,t) = \phi(L,t) = 0,$
$\phi(x,0) = f(x), \phi_t(x,0) = g(x)$ (9)

Q2. Solve: $\varphi_{xx} + \varphi_{yy} + \varphi_{zz} = \varphi_t$ (7)

Q3. Solve: $\varphi_{xx} + \varphi_{yy} = 0$ (8)

$\varphi(0, y) = 0, \varphi_x(L, y) = f(y),$
$\varphi(x, 0) = 0, \varphi(x, L) = 0$

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Roll No: 57923

Department of Mathematics, Government College University, Faisalabad

MSC 3rd Semester — Final Term Fall 2018

Course Title: Partial Differential Equations — Course Code: MTH-653

SUBJECTIVE PART — Time Allowed: — Marks: 30

Note: Attempt all five questions all question carry nine marks.

Q 2: State and prove convolution theorem in $x-$variable.

Q 3: Solve the initial-value problem by the method of Fourier transforms:

$$\begin{aligned} \frac{\partial^2 u}{\partial t^2} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0), \\ u(x,0) &= 0, \quad (-\infty < x < \infty), \\ u_t(x,0) &= g(x), \quad (-\infty < x < \infty). \end{aligned}$$

Q 4: Reduce the equation $u_{xx} + yu_{yy} = 0, \ y > 0$ to a canonical form.

Q 5: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\begin{aligned} \frac{\partial u}{\partial t} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (0 < x < a, \quad t > 0), \\ u(x,0) &= K_1, \quad (0 < x < a), \\ u_x(0,t) &= 0, \quad (t > 0), \\ u(a,t) &= K_2, \quad (t > 0). \end{aligned}$$

where c, a, K_1, and K_2 are constants.

Q 6: Solve the following boundary-value problem by the help of separation of variables method.

$$\begin{aligned} \frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} &= 0, \quad 0 < x < a, \quad 0 < y < b, \\ \phi(0,y) &= 0, \quad 0 < y < b, \\ \phi(a,y) &= 0, \quad 0 < y < b, \\ \phi(x,0) &= 0, \quad 0 < x < a, \\ \phi(x,b) &= f(x), \quad 0 < x < a. \end{aligned}$$

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PDEs Final

SUBJECTIVE PART

Q2. Show that under the general transformation, the type of PDE:
$a\varphi_{xx} + b\varphi_{xy} + c\varphi_{yy} + d\varphi_x + e\varphi_y + f\varphi = g(x, y)$ does not change. (5)

Q 3. Show that the equation: $e^x\varphi_{xx} - e^y\varphi_{yy} = 1$ is always hyperbolic and transform it into canonical form. (5)

Q 4. Solve: $\frac{\partial\varphi}{\partial t} - \frac{\partial^2\varphi}{\partial x^2} = 0$ subject to IC: $\varphi(x, 0) = 1 + \sin(\pi x)$ and BC's: $\varphi(0, t) = 1, \varphi(1, t) = 1$ by the method of Laplace transform. (5)

Q 5. Determine the Fourier Transform of $e^{-ax^2}\cos(cx)$ (5)

...ng system using Jacobi method correct to two decimal places:

$10x + y - z = 11.19, \quad x + 10y + z = 28.08, \quad -x + y + 10z = 35.61$

Question 9 State and prove the sufficient conditions on $g(x)$ for the conver...

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Department of Mathematics, Government College University, Faisalab

M.Sc 3rd Semester — Final Term Fall 202

Course Title: Partial Differential Equations — Course Code: MTH-

Subjective Part — Time Allowed: 1 Hr:30 Minutes — Marks: 18

Q 2: Solve the initial-value problem by the method of Fourier transforms:

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0),$$

$$u(x,0) = f(x), \quad (-\infty < x < \infty)$$

$$u_t(x,0) = 0, \quad (-\infty < x < \infty).$$

M Numan

Roll #6831

Q 3: Find the complex Fourier integral representation of

$$f(x) = e^{-a|x|}, \quad (-\infty < x < \infty, \quad a > 0).$$

Q 4: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}, \quad (0 < x < 3, \quad t > 0),$$

$$u(x,0) = 10\sin(2\pi x) - 6\sin(4\pi x), \quad (0 < x < 3),$$

$$u(0,t) = 0, \quad (t > 0),$$

$$u(3,t) = 0, \quad (t > 0).$$

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Dr Khadija

Roll No 7917 Reg. No. _____ Date _____ Sign _____

Department of Mathematics, Government College University, Faisalabad

MSC 3rd Semester Final Term Fall 2019

Course Title: Partial Differential Equations Course Code: MTH-650

Subjective Part Time Allowed: 1 Hr:30 Minutes Marks: 18

Q 2: Find the complex Fourier integral representation of (4)

$$f(x) = e^{-a|x|}, \quad (-\infty < x < \infty, \quad a > 0).$$

Q 3: Solve the initial-value problem by the method of.Fourier transforms: (4)

$$\begin{aligned} \frac{\partial^2 u}{\partial t^2} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (-\infty < x < \infty, \quad t > 0), \\ u(x,0) &= g(x), \quad (-\infty < x < \infty), \\ u_t(x,0) &= 0, \quad (-\infty < x < \infty). \end{aligned}$$

Q 4: Reduce the equation $yu_{xx} + (x+y)u_{xy} + xu_{yy} = 0$ to a canonical form. (5)

Q 5: Solve the following initial-boundary value problem by the method of Laplace transforms:

$$\begin{aligned} \frac{\partial u}{\partial t} &= c^2 \frac{\partial^2 u}{\partial x^2}, \quad (0 < x < a, \quad t > 0), \\ u(x,0) &= K_1, \quad (0 < x < a), \\ u_x(0,t) &= 0, \quad (t > 0), \\ u(a,t) &= K_2, \quad (t > 0). \end{aligned}$$

where c, a, K_1, and K_2 are constants. (5)

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