POKHARA UNIVERSITY

Level: Bachelor Semester: Fall

Programme: BE

Course: Engineering Mathematics II

Year : 2014

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

a) Find the shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ & $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ also find the equation of the line of shortest distance. 7

OR

Show that the lines x+y+z-3=0=2x+3y+4z-5 and 5x-y+5z-7=0=2x-5y-z-3 are coplanar. Find the equation of the plane in which they lie.

b) Find the equation of the sphere which passes through the circle $x^2+y^2+z^2-6x-2z+5=0$, y=0 and touch the plane 3y+4z+5=0. 8

a) State and prove Eulers theorem for function of two variables. Using it show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\tan u$, where $\sin u=\frac{x^2+y^2}{x+y}$. 7

b) Find the extreme values of the function $f(x)=x^2+y^2+z^2$ such that x + z = 1 and 2y + z = 2. 8

a) Evaluate $\int_0^2\int_{y^2}^4 y\cos x^2\,dx\,dy$, by interchanging the order of integration if it necessary. 7

b) Find the volume of the solid whose base is the region in the xy-plane that is bounded by the parabola $y = 4 - x^2$ and line y = 3x while the top of the solid is bounded by the plane z = x+4. 8

4. a) Solve y''+9y=cosec3x by using variation of parameter. 7

b) Define order and degree of the partial differential equation with examples and evaluate $\frac{dy}{dx}+\frac{y\log y}{x}=\frac{y(\log y)^2}{x^2}$. 8

5. a) Find the power series solution of the differential equation: $y''+8y=0$. 7

OR

Define Bessel equation and find its solution.

b) Solve : $y''+y'=2+x+x^2$, given that y(0)=-1 and $y'(0)=1$. 8

6. a) Using Laplace transformation solve the initial value problem $y''+y'-2y=t$ $y(0)=1$, $y'(0)=0$. 7

b) Find the Laplace transform of $t^2\sin 2t$. 4

c) Find the inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$. 4

7. Answer the followings: 4×2.5

a) Find the equation of sphere whose centre is at (1,-3,5) and radius 2.

b) Write down the equation of right circular cylinder whose axis is $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\delta}{n}$ and having radius a.

c) Find the equation of plane through the point (1,1,0), (1,2,1) and (-2,2,-1).

d) Find the laplace transform of f(t) = tcosh2t.

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2014
Programme: BE | | Full Marks: 100
Course: Engineering Mathematics II | | Pass Marks: 45
| | Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Find the image of the point (1,2,3) in the plane $2x-y+z+3=0$ 8

Or

Define shortest distance between two Skew lines in space. Find the length and equation of shortest distance between the lines 7

$$\frac{x}{2}=\frac{y}{-3}=\frac{z}{1} \text{ and } \frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+3}{2}$$

b) Find the equations of tangent planes to the sphere $x^2+y^2+z^2-2x+4y-6z+10=0$ which passes through line $\frac{x+3}{14}=\frac{y+1}{-3}=\frac{z-5}{4}$

2. a) State and prove Euler's theorem for homogeneous function of two variables and hence if $u=\tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$, $x\neq y$. and 8

Show that $x\frac{du}{dx}+y\frac{du}{dy}=Sin\,2u$.

b) If $f(x,y)=xy\frac{x^2-y^2}{x^2+y^2}$ when x and y are not simultaneously zero when x=0, y=0 show that at (0,0) $f_{xy}\neq f_{yx}$ 7

3. a) Evaluate $\int_0^{2}\int_0^{\sqrt{4-y^2}}\cos(x^2+y^2)dx\ dy$ by changing the order of integration 8

b) Find the volume in the first octant bounded by the co-ordinate planes, the cylinder $x^2+y^2=4$ and the plane $z+y=3$. 7

4. a) Define Bernoulli's equation. And Solve. $\frac{dy}{dx}+\frac{1}{x}\sin 2y=x^3\cos^2 y$

b) Solve the differential equation by using Wronskin's method of $y''+9y=\text{cosec}3x$.

5. a) Solve the differential equation $y''+y=0$, by using power series method.

Or

Write the Bessels function of first kind of order n. Prove that $\frac{d}{dx}\left[x^n J_n(x)\right]=x^n J_{n-1}(x)$.

b) Solve the following initial value problem. $y''-y'-2y=3e^{2x}$; $y(0)=0$; $y'(0)=-2$.

6. a) Define Laplace transform. State and prove second shifting theorem of Laplace transform.

Or

Evaluate:

i. $L\left\{\frac{\sinh t}{t}\right\}$

ii. $L^{-1}\left(\cot^{-1}\frac{s}{w}\right)$

b) Using Laplace Transform solve the initial value problem $y''+4y'+3y=e^{-t}$, $y(0)=1, y'(0)=1$

7. Write short notes on:

a) Find the angle between the planes: $x+3y+5z=0$ and $x-2y+z=10$

b) Define unit step function and find its Laplace transforms.

c) Solve $(x+1)y'=x(y^2+1)$

d) If $f=(ax^2+2hxy+by^2)$. Veify $f_{xy}=f_{yx}$.

POKHARA UNIVERSITY

Level: Bachelor Semester: Fall Year : 2015
Programme: BE Full Marks: 100
Course: Engineering Mathematics II Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Find the equation of plane through (α, β, γ) and the line x = py + q= rz +s. 7
   b) Find the image of the point (1,2,3) in the plane 2x-y+z+3=0. 8
2. a) State the Euleris theorem for a homogeneous function of two rariables and evaluate, if $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, then show that 1+6

   $$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + \frac{\cot u}{2} = 0.$$

   b) A rectangular box, open at the top, is to have a volume of 32c.c. Find the dimension of the box requiring least material for its construction. 8
3. a) Evaluate the integral $\int_0^{4a}\int_{y^2/4a}^{y} \frac{x^2 - y^2}{x^2 + y^2}\, dxdy$ changing into polar co-ordinates. 8
   b) Find the volume in the first octant bounded by co-ordinate planes, the cylinder $x^2+y^2=4$ and plane z+y=3. 7
4. a) State the condition for the exactness of differential equation. Hence solve. $x^2ydx-(x^3+y^3)dy=0$ 1+6
   b) Find the general solution of the differential equation: 8

   $$y'' - 2y' + y = \frac{12e^x}{x^3}.$$

5. a) Solve the differential equation y″-4y=0, by using power series methods. 8

   OR

   Define Legender's equation. Also derive the solution of Legender's equation.

   b) Solve the following intitial value problem. y″ +2y′+y= e^x, y(0) =-1, y′(0)=1 7
6. a) State and prove second shifting theorem on laplace transform. Using it evaluate L $(e^{-3t}u_2(t))$. 7
   b) State and prove exiestence theorem on laplace transform.

   OR

   Solve the differential equation: $y'' - 3y' + 2y = 4t + e^{3t}$, when y(0) = 1 and $y'(0) = -1$, by using Laplace transform. 8
7. Write short notes on 2.5×4
   a) Find the centre and radius of a sphere $x^2+y^2+z^2+4x-6y+8z=10$
   b) Solve: (xlogx)y′=y
   c) Find the laplace transform of f(t) =t cosht.
   d) Find the integrating factor of the differential equation: 2dx- $e^{y-x}dx = 0$

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Engineering Mathematics II

Semester: Spring

Year : 2015
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Find the co-ordinate of the foot of the perpendicular from the origin in the straight line $x+2y+3z+4=0,\ x+y+z+1=0$. 8

OR

Find the magnitude and equation of the shortest distance between the lines $\frac{x-5}{3}=\frac{7-y}{16}=\frac{z-9}{7}$ and $\frac{x-9}{3}=\frac{y-13}{8}=\frac{15-7}{5}$

b) Find the equation of sphere passing through (1, 0, 0), (0,1, 0) and (0,0,1) and their radius as small as possible. 7

2. a) State Euler's Theorem for partial derivatives of homogeneous function of two variables. If $u(x,y)=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$ 8

b) Find the dimension of the rectangular box, open at the top of maximum capacity whose surface is 432sq unit. 7

3. a) Find the volume of the tetrahedron bounded by the coordinate planes and the plane x+y+z=1. 8

b) Evaluate $\int_0^1\int_{4y}^{4} e^{x^2}dxdy$, by changing the order of integration. 7

4. a) Solve $\frac{dy}{dx}+\frac{1}{x}\ sin2y = x^3cos^2 y$ 8

b) Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+y=12\frac{e^x}{x^3}$

5. a) Solve by power series method $y''-4y=0$.

OR

Write the Bessel's function of first kind of order n. Prove that

$$\frac{d}{dx}\left[x^n j_n(x)\right] = x^n j_{n-1}(x).$$

b) Solve the following initial value problem
$y''-y'-2y=3e^{2x} : y(0)=0;\ y'(0)=2$

6. a) Evaluate the following
   i. $L(t^2\cos wt)$
   ii. $L(\cot^{-1}\frac{s}{w})$

b) Using Laplace Transform solve the initial value problem
$y''+4y'+3y=e^{-t},\ y(0)=0,\ y'(0)=1$

7. Write short notes on: (**Any two**)

a) Find the equation of tangent plane on the $x^2+y^2+z^2+4x+7y+9=0$ at (1,3,7).

b) Find the cosine angle between planes $x+2y+3z=4$ and $3x+4y+5z=10$

c) Find the laplace transform of $f(t)=t\cosh t$

d) Find the centre and radius of a sphere $x^2+y^2+z^2+4x-6y+8z=10$.

POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2016
Programme: BE | | Full Marks: 100
Course: Engineering Mathematics II | | Pass Marks: 45
| | Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Find the distance of the point (1,-3,5) from the plane 3x-2y+6z =15 along a line with direction cosines proportional to (2,1,-2). 7

OR

Find the shortest distance between the lines $\frac{x-5}{3}=\frac{7-y}{16}=\frac{z-3}{3}$ and $\frac{x-9}{3}=\frac{y-13}{8}=\frac{15-z}{5}$ also find the equation of the line of shortest distance.

b) Find the equation of the sphere having the circle $x^2 + y^2 + z^2 = 9$, $x - 2y + 2z = 5$ as a great circle. 8

OR

A sphere of radius K posses through the origin and meets the axes in A, B, C. Prove that the centroid of the triangle ABC lies on the sphere $9(x^2 + y^2 + z^2) = 4k^2$.

2. a) State and prove Euler's theorem on homogeneous function of x and y with degree n. If $u = \tan^{-1}(\frac{y^3+x^3}{x-y}), x \neq y$, then find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ 8

b) Find the minimum value of $f = x^2 + y^2 + z^2$, such that $xy + yz + zx = 3a^2$. 7

3. a) Sketch the region of integration of $\int_0^\infty\int_x^\infty \frac{e^{-y}}{y}\,dy\,dx$, and evaluate by interchanging the order of integration. 8

b) Find the volume enclosed between the cylinders $x^2 + y^2 - 2ax = 0$ and $z^2 = 2ax$ 7

4. a) Solve the equation: $x^2\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = 21x^{-4}$. 7

b) Solve: 8

$y'' + 9y = 6\cos 3x$

5. a) Find power series solution of the equation: $y'' + 4y = 0$ 8

b) Solve the initial value problem 7

$y'' - y' - y = 0,\ y(0) = -4,\ y'(0) = -17$

6. a) i) Find Laplace transform of $f(t) = \sin 2t\, u_\pi(t)$. 4+4

ii) Find f(t) if $F(s) = \log\frac{s(s+1)}{s^2+4}$

OR

State and prove the convolution theorem for Laplace transform. Use it to find f(t) where $F(s) = \frac{1}{s^2}$. 8

b) Solve the initial value problem by Laplace transform method: 7

$y'' + 4y' + 3y = e^{-t}\quad y(0) = 0,\quad y'(0) = 1.$

OR

State and prove convolution theorem of Laplace transform.

7. Attempt all 4×2.5

a) Find the cosine angle between planes $x + 2y + 3z = 4$ and $3x + 4y + 5z = 10$

b) Find the equations of the plane which passes through (2, −3, 1) and is normal to line joining the points (3, 4, −1) and (2, −1, 5).

c) Find the equation of tangent plane on the $x^2 + y^2 + z^2 + 4x + 7y + 9 = 0$ at (1, 3,5)

d) Find Laplace transform of f(t) = cos wt.

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2016
Programme: BE | Full Marks: 100
Course: Engineering Mathematics II | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Find the equation of the plane through (2,2,1), (1,-2,3) and parallel to the line joining the points (2,1,-3) and (-1,5,-8). 7

OR

Find the condition that the lines. $\frac{x-x_1}{L_1}=\frac{y-y_1}{m_1}=\frac{z-z_1}{n_1}$ and $\frac{x-x_2}{L_2}=\frac{y-y_2}{m_2}=\frac{z-z_2}{n_2}$ are coplanar.

b) Find the equation of the sphere having the circle $x^2+y^2+z^2=9$, $x-2y+2z=5$ as a great circle. Also determine its center and radius. 8

2. a) State and prove Euler's theorem on homogenous function of two independent variable of degree n. If $u = Sin^{-1}\left(\frac{x^3+y^3+z^3}{ax+by+cz}\right)$ prove that $x\frac{du}{dx}+y\frac{du}{dy}+z\frac{du}{dz}=2\ \text{Tan}u$. 7

b) Find the extreme values of a function $f(x,y,z) = x^2+y^2+z^2$ such that $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$. 8

3. a) Change the Cartesian Integral $\int_0^2\int_0^{\sqrt{4-y^2}} cos(x^2+y^2)dxdy$ into an equivalent polar Integral and evaluate it. 7

b) Find the volume in the first octant bounded by the coordinate planes, the cylinder $x^2+y^2=4$ and the plane $z+y=3$. 8

4. a) Solve $\frac{dy}{dx}+\frac{1}{x}\sin 2y = x^3\cos^2 y$ 7

b) Find the general solution of the differential equation: $y''-4y'+4y=6+\frac{e^{2x}}{x}$. 8

5. a) Find a power series solution of a differential equation: $y''-4y=0$. 7

b) Find the general solution of $\frac{d^2y}{dx^2}+2\frac{dy}{dx}+2y=4e^{-x}sec^3x$.

6. a) Evaluate the following :

i. $L(t^2\cos wt)$

ii. $L^{-1}\left(\frac{1}{s^2(s^2+w^2)}\right)$

b) Solve the differential equation: $y''-y'-2y=3e^{2t}$, $y(0) = y'(0)=-2$, by using Laplace transform.

OR

Find laplace inverse of following functions:

i. $\frac{1-e^{-\pi s}}{s^2-9}$

ii. $log\left(\frac{s+1}{s+5}\right)$.

7. Attempt all the questions:

a) Find center and radius of a sphere $x^2+y^2+z^2+4x-6y+8z=10$.

b) Solve: $(x^2+xy^2)dx+(x^2y+y^2)\,dy=0$.

c) Find Laplace transform of $f(t)=\frac{\sin 2t}{t}$.

d) Find Laplace transform of $f(t) = \text{Sin}at$.

POKHARA UNIVERSITY

Level: Bachelor Semester: Fall Year : 2017
Programme: BE Full Marks: 100
Course: Engineering Mathematics II Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

a) Reduce the equation of a line x+y+z+1=0, 4x+y-2z+2=0 in symmetrical form. 7

OR

Find the equation of the line through the point (1,6,3) perpendicular to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

b) Find the equation of the sphere which passes through the circle $x^2+y^2+z^2 = 5$, $x+2y+3z = 3$ and touch the plane $4x+3y = 15$. 8

a) State and prove Euler's theorem for a homogeneous function of two variable of degree n and hence if $v = \log\frac{x^2+y^2}{x+y}$, show that 8

$$x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} = 1.$$

b) Write down the necessary condition that f(x, y, z) to have maximum or minimum value. Show that the function $u = y^2 + x^2y + x^4$ has a minimum value at (0, 0). 7

a) Sketch the region of integration of $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y}\,dy\,dx$, and evaluate by interchanging the order of integration. 8

b) Find the volume of the solid whose base is the region in xy-plane that is bounded by the parabola $y = 3 - x^2$, $y = 2x$ while the top is bounded by the plane $z = x + 1$. 7

a) Solve $\frac{dy}{dx} - \frac{\tan y}{1-x} = (1+x)e^x \sec y$. 7

b) Solve $y'' + 9y = 6\cos 3x$, $y(0) = 1$, $y'(0) = 0$ 8

a) Solve by power series method $y' = 2xy$. 8

b) Use method of variation of parameter to solve 7

$$y'' + 2y' + y = e^{-x}\cos x$$

a) i Find Laplace transform of $f(t) = e^{-3t}\sin 2t$. 7

ii Find $f(t)$ if $F(s) = \log\frac{s(s+1)}{s^2+4}$.

b) Solve the following initial value problem by using Laplace transform 8

$$y'' + 2y' + 17y = 0, y(0) = 0, y'(0) = 12$$

OR

State and prove the convolution theorem for Laplace transform. Use it to find f(t) where $F(s) = \frac{1}{(s^2+1)^2}$.

Attempt all 4×2.5

a) Find the equations of the plane which passes through (-1, 3, 2) and is normal to the planes x+2y+2z=5 and 3x+3y+2z=8.

b) Express the equation of cone having three mutually perpendicular generators if a+b+c = 0

c) Prove that $l^2 + m^2 + n^2 = 1$

d) Find Laplace transform of Sin $(wt + \theta)$

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2017
Programme: BE | Full Marks: 100
Course: Engineering Mathematics II | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Prove that the lines $\frac{x+1}{1}=\frac{y+1}{2}=\frac{z+1}{3}$; x+2y +3z-8=0=2x+3y+4z-11 are coplanar and find the point of contact and equation of plane containing them. 8

   b) Prove that the circles 7
   $x^2+y^2+z^2-2x+3y+4z-5=0,\ 5y+6z+1=0$ and
   $x^2+y+z^2-3x-4y+5z-6=0,\ x+2y-7z=0$
   lie on the same sphere and find its equation.

2. a) State and prove Eulers theorem for homogeneous function of two variables in x and y of degree n. If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$. 7

   b) What are the criteria for a function of two independent variables to have extreme values? Find the minimum value of $f=x^2+y^2+z^2$ such that x+y+z = 1 and xyz = 1. 8

3. a) Draw the region of integration of $\int_0^{\pi}\int_x^{\pi}\frac{\sin y}{y}\,dy\,dx$, and find its value interchanging the order of integration. 7

   OR

   Find the volume of the solid in the first octant bounded by the coordinate planes, the cylinder $x^2+y^2=4$ and the plane $z+y=3$.J

   b) Evaluate $\int_0^{\frac{a}{\sqrt{2}}}\int_y^{\sqrt{a^2-y^2}}\log(x^2+y^2)\,dx\,dy,(a>0)$ by changing into polar integral. 8

4. a) Define Bernoulli's differential equation and solve
   $$\frac{dy}{dx}-\frac{\tan y}{1+x}=(1+x)e^x\sec y$$

   b) Solve $\frac{d^2y}{dx^2}-\frac{dy}{dx}+4y=\frac{e^x}{x}$ by method of variation of parameter.

5. a) Solve by power series method
   $(1-x)\,y^I=y$

   OR

   Define Bessel's differential equation and find the Bessel function first kind.

   b) Solve the following initial value problem.
   $$y''+2y'+y=e^{-x},\ y(0)=-1,\ y'(0)=1$$
   6

6. a) Define Laplace transform of a function. Using Laplace transf prove the following:

   i. $L(\sin at\ \cos at)=\frac{a(s^2-2a^2)}{s^4+4a^4}$

   ii. $L^{-1}\left\{\frac{1}{s^2(s^2+w^2)}\right\}=\frac{1}{w^2}\left(t-\frac{\sin wt}{w}\right)$

   b) Using Laplace Transform solve the initial value problem
   $$y''+4y'+3y=e^{-t},\ y(0)=y'(0)=1$$

7. 7. Attempt all questions

   a) Find the equation of the line through (1,3,5) and (2,3,4) perpendicul to the plane $3x-4y+5z=0$.

   b) Verify Euler's theorem for $f(x, y)=x^3+y^3+z^3$

   c) Solve the differential equation
   $(1+x)y\,dx+(1+y)x\,dy=0$

   d) Find the Laplace transform of te^{2t}

POKHARA UNIVERSITY

Level: Bachelor   Semester: Fall   Year : 2018
Programme: BE   Full Marks: 100
Course: Engineering Mathematics II   Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Find the image of the point (1,2,3) in the plane 2x-y+z+3=0. 8

OR

Find the shortest distance between the lines
$ax + by + cz + d = 0 = a_1x + b_1y + c_1z + d$, and z-axis.

b) Find the equation of sphere, its centre and radius which has the circle $x^2 + y^2 + z^2 = 9$, $x - 2y + 2z = 5$ as a great circle. 7

2. a) Write down the criteria for a function f(x, y) of two variables x and y to have maximum or minimum values at a point. 8
If the sum of the dimension of a rectangular swimming pool is given. Prove that the amount of water in the pool is maximum when it is cube.

b) State and prove Euler's theorem for homogeneous function of two variables. If $v = \log\left(\frac{x^2+y^2}{x+y}\right)$ Prove that $x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} = 1$. 7

3. a) Evaluate $\int_0^4\int_y^4 \frac{x\,dx\,dy}{x^2+y^2}$ by changing the order of integration. 8

b) Find the volume of the solid whose base is the region in the xy-plane that is bounded by the parabola $y = 4-x^2$ and line y=3x while the top of the solid is bounded by the plane z = x+4. 7

4. a) Solve $\frac{dy}{dx} + \frac{1}{x}\sin 2y = x^3\cos^2 y$ 7

b) Solve. y''+9y=sec3x; (method of variation of parameter) 8

5. a) Solve the differential equation : $(1+x^2)y''+xy'-y=0$, by using power series methods. 7

OR

Define Bessel Equation and Bessel function of order n. Also show that $\frac{d}{dx}[x^{-n}J_n(x)] = -x^{-n}J_{n+1}(x)$.

b) Solve the initial value problem: $y''-4y'+3y = 10e^{-2x}$ where $y(0) = 1$ and $y'(0) = 3$. 8

6. a) Define convolution theorem for inverse Laplace Transform and use it to find $L^{-1}\left(\frac{s}{(s^2+w^2)^2}\right)$ 8

b) Using Laplace Transform solve the initial value problem 7
$y'' - 4y' + 3y = e^{-t}$ $y(0) = y'(0) = 1$

7. Write short notes : 2.5×4
a) Find the equation of the plane through (−1, 1,−1) and (6, 2, 1) and normal to the plane 2x+y+z = 5.
b) Solve $e^{x-y}\,dx + e^{y-x}\,dy = 0$.
c) If $f(x,y,z) = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$, then show that $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} + z\frac{\partial f}{\partial z} = 0$.
d) Find f(t) if $F(s) = \frac{1}{s^2+36}$

POKHARA UNIVERSITY

Level: Bachelor Semester: Spring Year : 2018
Programme: BE Full Marks: 100
Course: Engineering Mathematics II Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Find the length of perpendicular from the point (3,-1, 11) to the line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Also find the equation of perpendicular. 8

OR

Find the shortest distance between the lines: ax+by+cz+d=0 $a_1x.b_1y+c_1z.d_1$ and z-axis.

b) Find the equation of the sphere through the circle $x^2 + y^2 + z^2 = 1$, $2x + 4y + 5z = 6$ and touching the plane $z = 0$. 7

2. a) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ show that: $x^2\frac{\partial^2 u}{\partial x^2 u} + 2xy\frac{\partial^2}{\partial x\partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\frac{\sin u \cos 2u}{4\cos^3 u}$ 7

b) If the sum of the dimension of a rectangular swimming pool is givon, show that the amount of water in the pool is maximum when it is a cube. 8

3. a) Evaluate $\int_0^2\int_0^{\sqrt{4-x^2}} \frac{xy}{\sqrt{x^2+y^2}}\,dy\,dx$ by changing polar integral. 7

b) Find the volume of the solid whose base is the region in xy-plane that is bounded by the parabola $y = 3 - x^2$, $y = 2x$ while the top is bounded by the plane $z = x + 1$. 8

4. a) Define order and degree of differential equations with suitable examples. Solve $\frac{dy}{dx} - y\tan x = 3e^{-\sin x}$ where y(0)=4. 7

b) Find the general solution of the differential equation $y'' - y = 2e^x + 6e^{2x}$. 8

5. a) Solve by power series method: $(1 + x)\,y' = y$.

OR

If $J_v(x)$ is the Bessel's function of order v. Prove that $J_{v-1}(x) - J_{v+1}(x) = 2J_v'(x)$

b) Use method of variation of parameter to solve $y'' + 4y' + 5y = 10e^{2t}$

6. a) Find the Laplace transform of
   i. tcosh at
   ii. t^2e^{-3t}

b) Solve by using Laplace transform:
$x'' + 2x' + 5x = e^{-t}\sin t, x(0) = 0, x'(0) = 1$

7. Attempt all the questions:
   a) Find the equation of the line passing through (1,5,3) and normal to the plane 2x+3y+7z=0
   b) Find the general solution of : $y'' - a^2y = 0$.
   c) If $f(x,y,z) = \frac{x}{y} + \frac{y}{z} + \frac{z}{x}$ show that $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} + z\frac{\partial f}{\partial z} = 0$
   d) Define Laplace transformation of f(t) and evaluate Laplace transform of Sin (wt + θ).

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Engineering Mathematics II

Semester: Fall

Year : 2019
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Define shortest distance between two skew lines in space. Find the length and equation of the shortest distance between the lines. $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ & $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ is $3\sqrt{30}$. 8
   b) Find the equation of the sphere through the circle $x^2+y^2+z^2=1$, $2x+4y+5z=6$ and touching the plane $z=0$. 7
2. a) State and prove Euler's theorem for function of two variables with degree n. If $u(x,y)=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\frac{1}{2}\tan u$. 8
   b) If $f(x,y)=xy\left(\frac{x^2-y^2}{x^2+y^2}\right)$ when x and y are not simultaneous zero when x=0, y=0 show that at (0,0) $f_{xy}+f_{yx}$ 7

   OR

   Find the minimum value of $f=x^2+xy+y^2+3z^2$ such that $x+2y+4z=60$.
3. a) Evaluate the integral $\int_0^{4a}\int_{y^2/4a}^{y}\frac{x^2-y^2}{x^2+y^2}\,dxdy$ changing into polar co-ordinates. 8
   b) Find the volume in the first octant bounded by coordinate planes, the cylinder $x^2+y^2=4$ and the plane $z+y=3$. 7
4. a) Define order of differential equations with suitable examples. Solve: 8

$$\frac{dy}{dx}-\frac{\tan y}{1+x}=e^x(1+x)\sec y.$$

   b) Solve: $\frac{d^2y}{dx^2}+10\frac{dy}{dx}+25y=e^{-5x}$ 7
5. a) Solve by power series method y" - 4y = 0. 7

   OR

   Write Bessel function of the first kind of order n. Show that $\frac{d}{dx}[x^n j_n x]=x^n j_{n-1}x$

   b) Solve the following initial value problem Solve the initial value problem 8

   $y''-4y'+3y=0,\ y(0)=-1,\ y'(0)=-5$
6. a) Define Laplace transform. State and prove Second shifting theorem of Laplace transform. Find the Laplace transform of 8
   i) $L(t^2\cos\omega t)$
   ii) $L(\cot^{-1}\frac{s}{w})$.
   b) Using the method of Laplace transform, solve the initial value problem $9y''-6y'+y=0, y(0)=3, y'(0)=1$. 7
7. Write short notes on: 2.5 x 4
   a) Find the direction cosine of line perpendicular to plane $3x-4y+5z=7$.
   b) Write the general equation of a cone with its vertex at the origin.
   c) Define unit step function and find its Laplace transform
   d) Find Laplace transform of $\frac{1-\cos 2t}{4}$

POKHARA UNIVERSITY

Level: Bachelor   Semester: Spring   Year : 2019
Programme: BE   Full Marks: 100
Course: Engineering Mathematics II   Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Find the equation to the plane through the line 2x+3y-5z-4=0=3x-4y+5z-6, parallel to the z-axis. 8

   b) Find the equation of the sphere through the circle $x^2+y^2+z^2=4$, $z=0$ and is cut by the plane $x+2y+3z=0$ in a circle of radius 3. 7

2. a) State and prove Euler's Theorem on homogenous function of two independent variable of degree n. if $u = Sin^{-1}\left(\frac{x^3+y^3+z^3}{ax+by+cz}\right)$ prove that $x\frac{du}{dx}+y\frac{du}{dy}+z\frac{du}{dz} = 2\tan u$ 8

   b) A rectangular box open at the top, is to have a volume of 32C.C.Find the dimensions of the box requiring least material for its construction. 7

3. a) Evaluate the integral $\int_0^{4a}\int_{y^2/4a}^{y}\frac{x^2-y^2}{x^2+y^2}\,dxdy$ changing into polar co-ordinates. 8

   b) Find the volume of the solid cut from the first octant by the surface $Z = 4-x^2-y$. 7

4. a) Solve the equation $\frac{dy}{dx}+\frac{y\log y}{x}=\frac{y(\log y)^2}{x^2}$ 7

   b) Solve the initial value problem. $y''+y'-2y = 14+2x-2x^2$, $y(0)=0$, $y'(0)=0$. 8

5. a) Solve $y''-4xy'+(4x^2-2)y=0$ by using power series method. 7

   OR

   Define Bessel equation and Bessel function of order n Also show that $\frac{d}{dx}[x^{-n}j_n(x)]=-x^{-n}j_{n+1}(x)$

   b) Find the general solution of $y''-4y'+5y=e^{2x}\operatorname{cosec} x$ by using method of variation o.

6. a) Define Laplace transform. Evaluate

   i) $L(t^2\sin wt)$ ii) $L^{-1}\left(\frac{1}{s^2(s^2+w^2)}\right)$

   b) Using Laplace Transform solve the initial value problem $y''-3y'+2y=4t+e^{3t}$ $\quad y(0)=y'(0)=-1$.

7. Attempt all the questions.

   a) Find the equation of plane which through (1,1,1) and parallel plane $3x-4y+5z=0$.

   b) Find Laplace transform of $e^{-2t}\cos t$.

   c) Solve : $\frac{dy}{dx}+y\cot x=e^{\cos x}$,

   d) If $V=\sqrt{x^2+y^2+z^2}$ Show that $V_{xx}+V_{yy}+V_{zz}=\frac{2}{V}$

POKHARA UNIVERSITY

Level: Bachelor Semester:Fall Year : 2020

Programme:BE Full Marks: 100

Course:Engineering Mathematic II Pass Marks: 45

Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

a) Find the image of the point (1, 2, 3) in the plane 2x-y+z+3=0. 8

OR

Define shortest distance between two skew lines in space. Find the length and equation of shortest distance between the lines $\frac{x}{2}=\frac{y}{-3}=\frac{z}{1}$ and $\frac{x-2}{3}=\frac{y-1}{-5}=\frac{z+3}{2}$

b) Find the equation of the sphere through the circle $x^2+y^2+z^2=1$, $2x+4y+5z=6$ and touching the plane $z=0$. 7

2. a) State and prove Euler's theorem for homogeneous function of two variable. If $u=\tan^{-1}\left(\frac{x^3+y^3}{x+y}\right), x\neq y$, Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\sin 2u$ 8

b) What are the criteria of a function of two independent variables to have extreme values? Find the extreme value of f=xyz subject to x + y + z = 24. 7

3. a) Evaluate $\int_0^2\int_x^2 y^2\sin xy\, dy\, dx$ by reversing the order of integrations. 8

b) Find the volume in the first octant bounded by coordinate planes, the cylinder $x^2+y^2=4$ and the plane $z+y=3$. 7

4. a) Solve: $\frac{dy}{dx}+\frac{1}{x}\sin 2y=x^3.\cos^2 y$ 7

b) Solve $\frac{d^2x}{dy^2}-2\frac{dy}{dx}+y=12\frac{e^x}{x^3}$ 8

5. a) Find the solution of the differential equation: $y''+4y=0$, by using power series method. 7

b) Solve $y''+2y+y=e^{-x}$ $y(0)=-1$, $y'(0)=1$ 8

6. a) Find Laplace transform of (i) $\frac{\cosh t}{t}$ (ii) $(t-1)u(t-1)$ 8

b) Solve the initial value problem: $y''-2y'+y=e^t, y(0)=2, y'(0)=-1$, by using Laplace transform. 7

7. Write short notes on: 10

a) Find the equation of the line passing through the (1, 5, 3) and perpendicular to the plane 2x + 3y + 7z = 0

b) Find the partial derivatives of $f(x,y)=x\cos\left(\frac{x}{y}\right)$.

c) Evaluate $\int_0^1\int_0^2 xy\,dy\,dx$.

d) Find laplace transform of t^n.