Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering Second Year Even Semester Examination, 2019

Math 2201

Mathematics-IV

Time: 3 Hours

Marks: 72

N.B.:
- (i) Answer any SIX questions, taking THREE from each section.
- (ii) Figure in the margin indicate full marks.
- (iii) Use separate answer script for each section.
- (iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Determine a unit normal to the following surface $\bar{r} = a\cos u \sin v\underline{i} + a\sin u \sin v\underline{j} + a\cos v\underline{k}$ where $a > 0$. 4.00

(b) Find the equations for the tangent plane and normal line to the surface $4z = x^2 - y^2$ at the point (3, 1, 2). 4.00

(c) Show that $\vec{V} = (x+2y+4z)\underline{i} + (2x-3y-z)\underline{j} + (4x-y+2z)\underline{k}$ is irrotational. Find ϕ such that $\vec{V} = \bar{\nabla}\phi$. 4.00

Q.2 (a) Prove that $\int_{P_1}^{P_2} \bar{F}.d\bar{r}$ is independent of the path joining any points P_1 and P_2 in a given region, then $\oint \bar{F}.d\bar{r} = 0$ for all closed paths in the region and conversely. 6.00

(b) Let $\bar{F} = 2xz\underline{i} - x\underline{j} + y^2\underline{k}$, evaluate $\iiint_V \bar{F}dV$ where V is the region bounded by the surfaces $x=0,\ y=0,\ y=6,\ z=x^2,\ z=4$. 6.00

Q.3 (a) If $F(t) = t^2,\ \ 0 < t < 2$ and $F(t+2) = F(t)$, find $L\{F(t)\}$. 6.00

(b) Solve the differential equation $ty'' + y' + 4ty = 0$ where $y(0) = 3,\ y'(0) = 0$ using Laplace transformation. 6.00

Q.4 (a) Verify Stoke's theorem for $\bar{A} = (y-z+2)\underline{i} + (yz+4)\underline{j} - xz\underline{k}$ where S is surface of the cube $x=0,\ y=0,\ z=0,\ x=2, y=2, z=2$ above the xy plane. 6.00

(b) Define Laplace transfonnation. By using first shifting theorem prove that 3.00

$$L\{t\sin at\} = \frac{2as}{(s^2+a^2)^2}.$$

(c) Evaluate $L^{-1}\left\{\dfrac{s+3}{4s^2+4s+1}\right\}$. 3.00

SECTION-B

Q.5 (a) Write a short note on Skewness and Kurtosis of frequency distribution. 4.00

(b) A computer while computing the mean and standard deviation of 25 observations, obtained the following values: mean=56 inches, S.d.=2 inches. It was later discover at the time of checking that he had wrongly copied down on observation as 64, what is the mean and S.d. for correct observation. 4.00

(c) The first of two samples have 100 items with mean 15, standard deviation 3. If the whole group has 250 items with mean 15.6 and standard deviation $\sqrt{13.44}$, find the standard deviation of the rest group. 4.00

Q.6 (a) From 10 observations on price(X) and supply(Y) of commodity, the following summary figures were obtained in appropriate units: 6.00

$\sum X = 136,\ \sum Y = 243, \sum X^2 = 2278, \sum XY = 3476,\ \sum Y^2 = 6129$. Compute the correlation coefficient between the supply and price.

(b) Find the standard deviation of the following distribution: 6.00

Age:	20-25	25-30	30-35	35-40	40-45	45-50
No of persons:	170	110	80	45	40	35

Q.7 (a) The first of four moments of a distribution about the value 4 of the variable are -1.5, 17, -30 and 102. Find the moment about the mean. Calculate β_1 and β_2 and comments about the shape of the curve. 5.00

(b) A continuous function $f(x) = Ce^{-kx}$, $k > 0$ and $0 \le x < \alpha$, what is the value of C when $f(x)$ represents a probability distribution? Find also its standard deviation. 4.00

(c) Establish the relation between standard and root mean square deviation. 3.00

Q.8 (a) What is regression? Fit a regression line y on x to the following data using least square method. 5.00

x	16	19	25	28	36	40
y	192	218	210	232	236	249

(b) Find the mean and variance of Normal distribution. 4.00

(c) Assume the mean heights of soldiers to be 68.22 inches with a variance of 10.8 inch². How many soldiers in a regiment of 1000 would you expect to be over 6 feet tall? 3.00

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **SECOND** Year **EVEN SEMESTER** Examination, 2018

Math 2201

Mathematics-IV

Full Marks: 72 **Time: 3 Hours**

N.B.:-
- (i) Answer any **SIX** questions, taking **THREE** from each section.
- (ii) Figure in the margin indicate full marks.
- (iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) Prove that a necessary and sufficient condition for the vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ to be coplanar is that $\vec{A}.(\vec{B}\times\vec{C}) = 0$. 4.00

(b) In what direction from the point *(2, 1, -1)* is the directional derivative of $\emptyset = x^2yz^3$ a maximum? What is the magnitude of this maximum? 4.00

(c) Find the equation of the tangent plane and the normal line to the surface $xyz^2 = 4$ at *(2, 2, 1)*. 4.00

Q.2 (a) Evaluate $\iint_S \vec{A}.\vec{n}\,ds$ over the entire surface *S* of the region bounded by the cylinder $x^2 + y^2 = 9$, $x = 0, y = 0, z = 0$ and $y = 8$ if $\vec{A} = 6z\vec{i} + (2x + y)\vec{j} - x\vec{k}$. 6.00

(b) Demonstrate the Divergence Theorem physically. Verify the Divergence Theorem for $\vec{A} = 2x^2z\vec{i} - y^2\vec{j} + 4xz^2\vec{k}$ taken over the region in the first octant bounded by $y^2 + z^2 = 9$ and $x = 2$. 6.00

Q.3 (a) Define Laplace transform. Prove that $L\{e^{at}sinbt\} = \frac{b}{(s-a)^2+b^2}$. 4.00

(b) If $L\{F(t)\} = f(s)$ and $G(t) = \begin{cases} F(t-a), & t > a \\ 0, & t < a \end{cases}$ then show that $L\{G(t)\} = e^{-as}f(s)$ 4.00

(c) Calculate $L^{-1}\left\{\frac{2s+5}{(s^2+1)(s-4)}\right\}$. 4.00

Q.4 (a) Solve the Laplace transform $t\frac{d^2y}{dt^2} + \frac{dy}{dt} + 4ty = 0$ where $y'(0) = 0,\ y(0) = 3$ 6.00

(b) Solve the Laplace transform $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $u(x,0) = 3sin2\pi x$, $u(0,t) = 0$, $u(1,t) = 0$ where $0 < x < 1$. 6.00

SECTION-B

Q.5 (a) The correlation coefficient between supply (Y) and price (X) of a commodity is 0.60. If $\sigma_x = 1.50$, $\sigma_y = 2.0$, $\bar{X} = 10$ and $\bar{Y} = 20$. find the equations of the regression lines of Y on X and X on Y. 6.00

(b) Calculate upper quartile, β_1 and β_2 from the following data: 6.00

Expenditure :	10-20	20-30	30-40	40-50	50-60
No. of families :	14	25	27	26	15

Q.6 (a) The mean of two samples of sizes 50 and 100 respectively are 54.4 and 50.3 and the standard deviations are 8 and 7. Obtain the mean and standard deviation of the sample of size 150 by combining the two samples. 6.00

(b) An incomplete frequency distribution is given follows: 6.00

Variable:	10-20	20-30	30-40	40-50	50-60	60-70	70-80	
Frequency:	12	30	?	65	?	25	18	= 229

Given that the median value is 46. Determine the missing frequencies.

Q.7 (a) A committee of 4 people is to be appointed from 3 officers of the purchase department, 4 officers of the production department, 2 officers of the sales department and 1 chartered accountant. Find the probability of forming the committee in the manner. 4.00

- (i) It should have at least one from the purchase department.
- (ii) The chartered accountant must be in the committee.

(b) A continuous random variable x has a probability density function $f(x) = 3x^2$ $0 \le x \le 1$. Find a and b such that (i) $P(x \le a) = P(a > x)$ and (ii) $P(x > b) = 0.05$. 5.00

(c) The probability that machine A will be performing an usual function in 5 years time is ¼, while the probability that machine B will still be operating usefully at the end of same period is 1/3. Find the probability in the following cases that in 5 years time. 3.00

50KN/m

- (i) Both machines will be performing an usual function.
- (ii) Neither will be operating.
- (iii) Only machine B will be operating.
- (iv)

Q.8 (a) A skilled typist on routine work kept a record of mistakes made per day during 300 working days. Fit a Poisson's distribution to the following data: 6.00

Mistakes per day:	0	1	2	3	4	5	6
No. of days:	143	90	42	12	9	3	1

(b) Calculate the skewness and kurtosis of the following data: 6.00

x:	1	2	3	4	5	6	7	8	9
f:	1	6	13	25	30	22	9	5	2

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering SECOND Year EVEN SEMESTER Examination, 2017

Math 2201
Mathematics-IV

Full Marks: 72 **Time: 3 Hours**

N.B.:-
- (i) Answer any **SIX** questions, taking **THREE** from each section.
- (ii) Figure in the margin indicate full marks.
- (iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) If $\vec{a}$, $\vec{b}$, $\vec{c}$ are non-coplaner vectors determine whether the vectors $\vec{r}_1 = 2\vec{a} - 3\vec{b} + \vec{c}$, $\vec{r}_2 = 3\vec{a} - 5\vec{b} + 2\vec{c}$ and $\vec{r}_3 = 4\vec{a} - 5\vec{b} + \vec{c}$ are linearly independent or dependent. 3.00

(b) If $\vec{A} = 2\underline{i} + \underline{j} - 3\underline{k}$ and $\vec{B} = \underline{i} - 2\underline{j} + \underline{k}$, find a vector of magnitude 5 perpendicular to both $\vec{A}$ and $\vec{B}$. 4.00

(c) Find the equation of the tangent plane and the normal line to the surface $xyz^2 = 4$ at the point $(2,2,1)$. 5.00

Q.2 (a) Show that $\vec{F} = (\sin y + z)\underline{i} + (x\cos y - z)\underline{j} + (x - y)\underline{k}$ is irrotational. Is $\vec{F}$ conservative? If so, find a scalar function φ such that $\vec{F} = \vec{\nabla}\varphi$. 4.00

(b) Suppose that the surface S has projection R on the xy-plane. Show that $\iint_S \vec{A}.\hat{n}ds = \iint_R \vec{A}.\hat{n}\frac{dxdy}{|\hat{n}.\underline{k}|}$ 4.00

(c) Evaluate $\iint_S (\vec{\nabla} \times \vec{F})\hat{n}ds$, where $\vec{F} = (x + 2y)\underline{i} - 3z\underline{j} + x\underline{k}$ and S is the surface of $2x + y + 2z = 6$ bounded by $x = 0$, $x = 1$, $y = 0$ and $y = 2$. 4.00

Q.3 (a) State and prove stoke's theorem. 5.00

(b) Define Laplace transformation. Find the Laplace transform of $9e^{-7t} - 3t^6 - 2\sin 5t - 5t^2\cos 2t$. 4.00

(c) Evaluate $L^{-1}\left[\frac{1}{s^3(s^2+1)}\right]$ 3.00

Q.4 (a) Using Laplace transformation solve $y'' + 4y = e^{-t}$, where $y(0) = y'(0) = 0$ 6.00

(b) Solve the PDE $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$; $u(0,t) = 0$, $u(3,t) = 0$, $u(x,0) = 10\sin 2\pi x - 6\sin 4\pi x$ by using laplace transformation. 6.00

SECTION-B

Q.5 (a) What do you understand by dispersion? 3.00

(b) The first four moments of a distribution about the value 5 of the variable are 2, 20, 40 and 50. Find skewness and kurtosis and comment about the nature of the curve. 4.00

(c) The following are the scores of two batsman A and B in a series of innings: 5.00

A:	15	101	8	80	10	120	35	15
B:	48	10	35	22	50	60	25	34

Who is the better scorer and who is more consistent player? Justify your answer.

Q.6 (a) Find the coefficient of (i) skewness (ii) kurtosis for the distribution with density function 6.00

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

(b) A committee of 4 people is to be appointed from 3 officers of the purchase department, 4 officers of the production department, 2 officers of the sales department and 1 chartered accountant. Find the probability of forming the committee in the following manner: 6.00
- (i) There must be one from each category.
- (ii) It should have at least one from the purchase dept.
- (iii) The chartered accountant must be in the committee

Q.7 (a) Find the mean and variance of Normal distribution. 4.00

(b) 255 metal rods were cut roughly 6 inches oversize. Finally the lengths of the oversize amount were measured exactly and grouped with 1-inch intervals, there being in all 12 groups. The frequency distribution for the 255 lengths was: 5.00

Central value x:	1	2	3	4	5	6	7	8	9	10	11	12
Frequency y:	2	10	19	25	40	44	41	28	25	15	5	1

It is required to fit a normal curve to this data.

(c) Write a short notes on stratified sampling and multi stage sample. 3.00

Q.8 (a) Find the correlation coefficient of the following data: 6.00

Weight	64	71	53	67	55	58	77	57	56	51
Height	57	59	49	62	51	50	55	48	52	42

(b) A die is tossed 120 times. Find the probability that the face 4 will turn up 14 times or less, assuming that the die is fair, by 6.00
- (i) Binomial distribution
- (ii) Normal approximation to binomial distribution

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **SECOND** Year **EVEN SEMESTER** Examination, 2015

Math 2201

Mathematics IV

Full marks: 72 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) Define triple product of vector. Find the constant λ such that $2\vec{i}-\vec{j}+\vec{k}$, $\vec{i}+2\vec{j}-3\vec{k}$ and $3\vec{i}+\lambda\vec{j}+5\vec{k}$ are coplanar. 04

(b) If C_1 and C_2 are constant vectors and λ is a constant scalar, show that $H=e^{-\lambda x}(C_1\sin\lambda y+C_2\cos\lambda y)$ satisfies the partial differential equation $\frac{\partial^2 H}{\partial x^2}+\frac{\partial^2 H}{\partial y^2}=0$. 04

(c) Find the direction derivative of $P=4e^{2x-y+z}$ at the point (1,1,-1) in a direction towards the point (-3,5,6). 04

Q.2 (a) If $L\{F(t)\}=f(s)$ and $G(t)=\begin{cases}F(t-a) & t>a\\ 0 & t<a\end{cases}$, then show that $L\{G(t)\}=e^{-as}f(s)$ and also find $L\{F(t)\}$ where $F(t)=\begin{cases}\cos(t-2\pi/3) & t>2\pi/3\\ 0 & t<2\pi/3\end{cases}$ 05

(b) Find $L^{-1}\left\{\frac{s+1}{6s^2+7s+2}\right\}$ 03

(c) Show that $L\left\{\frac{d^2y}{dt^2}\right\}=s^2y-sy(0)-y'(0)$. 04

Q.3 (a) A husband and wife appear in an interview for two vacancies in the same post. The probability of husband selection is 1/7 and that of wife selection is 1/5. What is the probability that (i) both of them will be selected (ii) only one of them will be selected (iii) none of them will be selected. 06

(b) Find mean and variance of the normal distribution. 06

Q.4 (a) Write a short note on "Skewness and Kurtosis of a distribution". 04

(b) State the various types of averages and examine the merits and demerits of each a measure of central tendency. 04

(c) If A and B are any two events and are not disjoint, then show that $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. 04

SECTION-B

Q.5 (a) The average marks of 200 students (in statistics) are 60% and S.D. is 6.5. How many students get (i) more and equal to 80% marks, (ii) Less than 40% marks? Assume marks are normally distributed and find the area under the normal curve by Simpson's 1/3 rule. 06

(b) A random variable x has the density function $f(x)=\frac{C}{x^2+1}$, where $-\alpha<x<\alpha$. Find the value of constant C. 06

Q.6 Solve the differential equations by using Laplace transformation: 12

(i) $Y''+2Y'+5Y=e^{-t}\sin t,\quad Y(0)=0, Y'(0)=0$

(ii) $Y''-tY'+Y=1,\quad Y(0)=1, Y'(0)=2$

Q.7 (a) Establish Poisson distribution from Binominal distribution. 04

(b) Find the mean and variance of Poisson distribution. 04

(c) A skilled typist, on routine work kept a record of mistakes made per day during 300 working days. Fit a Normal distribution to the following data: 04

Mistakes per day	0	1	2	3	4	5	6
No. of days	143	90	42	12	9	3	1

Q.8 (a) Find the Rank correlation from the following data: 06

X	16	19	25	28	25	30	32	36
Y	192	218	210	232	218	236	210	236

(b) What is sampling? Write short notes on stratified sampling and sequential sampling. 06

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Heaven's Light is Our Guide
DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering **Second Year Fourth** Semester Examination, 2014

BABLA
120020

Math 203
Mathematics IV

Full marks: 70 | **Time: 3 Hours**

N.B:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) Calculate coefficient of skewness and Kurtosis for the data — 6.00

Value x_i	12	24	36	48	60	72	84
Frequency f_i	8	14	18	36	30	20	10

(b) A box holds 5 white, 3 black and 7 orange balls. If two balls are drawn at random and x denotes the number of orange balls — 5.67
(i) find the probability distribution for x and (ii) graph the distribution.

Orange 7 Others 8

Q.2 (a) Find the standard deviation of Normal distribution. The mean weight of 500 students is 120 lb and the standard deviation is 13 lb. Assuming that the weights are normally distributed. Find how many students weight between 120 and 155 lb? — 6.00

(b) Write a short note on (i) Stratified sampling (ii) Systematic sampling. — 5.67

Q.3 (a) Find the variance of Binomial distribution. — 4.00

(b) A committee of 4 people is to be appointed from 3 officers of the production department, 4 officers of the purchase department, 2 officers of the sales department and 1 chartered accountant. Find the probability that (i) There must be one from each category (ii) The committee must have at least one from the purchase department. — 5.00

(c) A die is thrown 8 times and it is required to find the probability that 3 will show (i) at least once (ii) at most 7 times. — 2.67

Q.4 (a) In a certain factory producing cycle tyres, there is a small chance of 1 in 500 tyres to be defective. The tyres are supplied in lots of 10. Using Poisson's distribution calculate the approximate number of lots containing no defective and two defectives tyres respectively in a consignment of 8,000 lots. — 4.00

(b) The diameter of a electric cable is assumed to be continuous random variable with probability density function $f(x) = x(5 - x^2)$, $0 \le x \le 2$, find mean and variance. — 4.00

(c) Two judges A and B in a beauty contest rank the ten competitors in the following order: — 3.67

A :	4	3	1	2	7	9	8	10	5	6
B :	1	6	7	5	8	10	9	3	2	4

Do the two judges appear to agree in their standard?

SECTION-B

Q.5 (a) Define dot product and cross product. Write down their physical and geometrical meaning. — 3.67

(b) Explain the vector differentiation. — 4.00

(c) Find an equation for the tangent plane to the surface $2xz^2 - 3xy - 4x = 7$ at the point $(1,-1,2)$. — 4.00

Q.6 (a) State and prove Green's Theorem in the plane. — 4.00

(b) Show that (i) $\nabla \times \nabla\phi = 0$ (ii) $\nabla.(\nabla \times \vec{A}) = 0$. — 3.67

(c) Define irrotational. Find constants a, b, c so that $\vec{A} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ is irrotational. — 4.00

Q.7 (a) Define Laplace transformation and its inverse. Find the Laplace transformation (i) t^n (ii) $t^3 e^{at}$. — 5.67

(b) Evaluate: (i) $L^{-1}\left\{\dfrac{6S-4}{S^2 - 4S + 20}\right\}$ (ii) $L^{-1}\left\{\dfrac{S}{\left(S^2 + a^2\right)^3}\right\}$. — 6.00

Q.8 Solve the differential equations: — 11.67

(i) $Y'' - 3Y' + 2Y = 4e^{2t}$, $Y(0) = -3$, $Y'(0) = 5$.

(ii) $\dfrac{\partial U}{\partial t} = \dfrac{\partial^2 U}{\partial x^2}$, $U(x,0) = 3Sin2\pi x, U(0,t) = 0, U(1,t) = 0$, where $0 < x < 1$.

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Heaven's light is our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **SECOND** year **FOURTH SEMESTER** Examination, 2013

Math 203

Mathematics-IV

Full Marks: 70 **Time: 3 Hours**

N.B.:- (i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a) Define linearly dependent and independent vectors. To determine whether the following vectors are linearly independent and dependent: 4.00

$\vec{A}=2\hat{i}+\hat{j}-3\hat{k}$, $\vec{B}=\hat{i}-4\hat{k}$, $\vec{C}=4\hat{i}+3\hat{j}-\hat{k}$

(b) A force given by $\vec{F}=3\hat{i}+2\hat{j}-4\hat{k}$ is applied at the point (1,-1, 2). Find the moment of $\vec{F}$ about the point (2,-1,3). 3.67

(c) A particle moves along the curve $x = 2t^2$, $y = t^2-4t$, $z = 3t-5$, where t is the time. Find the components of its velocity and acceleration at time t=1 in the direction $\hat{i}-3\hat{j}+2\hat{k}$ 4.00

Q.2(a) State and prove Divergence Theorem. 6.00

(b) Verify Stokes Theorem for the vector $\vec{A}=(y-z+2)\vec{i}+(yz+4)\vec{j}+xz\vec{k}$, where S is the surface of the cube x=0, y=0, z=0 , x=2, y=2, z=2 above the xy plane. 5.67

Q.3(a) Show that $L\{t^2q(t-2)\}=\frac{2}{s^3}-\frac{2e^{-2s}}{s^3}(1+2s+2s^2)$, s>0 , where q(t-2) is unit step function. 4.00

(b) Find the Laplace transform of t^2e^{at} 3.67

(c) Define inverse Laplace transform. Find $L^{-1}\left\{\frac{5s^2-15s-1}{(s+1)(s-2)^2}\right\}$ 4.00

Q.4 Solve the following differential equations by Laplace transform 11.67

(i) $Y''-tY'+Y=1, Y(0)=1, Y'(0)=2$

(ii) $\frac{\partial U}{\partial t}=\frac{\partial^2 U}{\partial x^2}$; under the conditions $U(x,0)=3\sin 2\pi x, U(0,t)=0, U(1,t)=0$ where 0<x<1, t>0.

SECTION-B

Q.5(a) State various types of averages and write merits and demerits of each measure of central tendency. 3.00

(b) Show that $\sum \delta_i(x_i-a)^2$ has a minimum value. 3.67

(c) The mean of two samples of sizes 50 and 100 respectively are 54.4 and 50.3 and the standard deviations are 8 and 7. Obtain the mean and standard deviation of the sample of size 150 obtained by combining the two samples. 5.00

Q.6(a) Calculate Skewness and Kurtosis of the following data and comment about the shape of the curve. 6.00

x:	1	2	3	4	5	6	7	8	9
y:	1	6	13	30	25	22	9	5	3

(b) Series of two golfers for 12 rounds were as follows: 5.67

Golfer A:	74	75	78	81	84	73	68	71	76	80	67	72
Golfer B:	91	84	81	88	86	89	79	81	83	78	80	82

Find which golfer may be considered to be a more consistent player?

Q.7(a) A random variable x has density function $f(x)=\frac{C}{x^2+1}$, where $-\infty<x<\infty$. Find the value of C. 5.67

(b) What is best fitting curve? Derive the normal equation for the least square line. 6.00

Q.8(a) Fit a normal distribution curve to the following data. 6.00

x	8.60	8.59	8.58	8.57	8.56	8.55	8.54
$f(x)$	2	3	4	9	11	7	5

(b) Find the rank correlation for the following data: 5.67

x:	65	63	67	64	68	62	70	67	68
y:	68	66	68	65	69	66	65	70	71

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DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B Sc. Engineering SECOND year FOURTH SEMESTER Examination, 2012

Math-203
Mathematics – IV

Full Marks: 70 **Time: 3 Hours**

N.B.: –
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a) Determine whether the vectors $\vec{r}_1 = 2i - j + k$, $\vec{r}_2 = i + 3j - 2k$, $\vec{r}_3 = -2i + j - 3k$ and $\vec{r}_4 = 3i + 2j + 5k$ are linearly independent or dependent. 3.67

$r_4 = a_1 r_1 + a_2 r_2 + a_3 r_3$

(b) Show that $\vec{F} = (\sin y + z)i + (x\cos y - z)j + (x - y)k$ is irrotational. Is $\vec{F}$ conservative? If so, find a function φ such that $\vec{F} = \nabla\varphi$. 4.00

$x\sin y + xz - yz$

(c) Find an equation for the tangent plane and normal line to the surface $z = x^2 + y^2$ at the point $(2, -1, 5)$. 4.00

$4x - 2y - z = 5$

$\frac{x-2}{4} = \frac{y+1}{-2} = \frac{z-5}{-1} = u$

Q.2(a) Suppose that the surface S has projection R on the xy plane. Show that – 6.00

$$\iint \vec{A}.\vec{n}.ds = \iint_R \vec{A}.\vec{n}.\frac{dx.dy}{|\vec{n}.\vec{k}|}.$$

(b) Verify divergence theorem for $\vec{A} = 4xi - 2y^2 j + z^2 k$, taken over the region bounded by [illegible], $z = 0$ and $z = 3$. 5.67

Q.3(a) Find (i) $L\left\{\frac{e^{[illegible]} - e^{[illegible]}}{t}\right\}$ $\ln\frac{s+3}{s+5}$ (ii) $L^{-1}\left\{\frac{s+4}{s^2 + 2s + 7}\right\}$ $e^{-t}\cos\sqrt{6}t + \frac{\sqrt{3}}{\sqrt{2}}e^{-t}\sin\sqrt{6}t$ 6.00

(b) Find the Laplace transformation of F(t), when F(t) is a periodic function with period 2π, such that 5.67

$F(t) = \begin{cases} [illegible] & [illegible] \\ 0, & [illegible] < t < 2\pi \end{cases}$

$\frac{2e^{-2\pi s}}{(1 - e^{-2\pi s})(4\pi^2 + 1)}$

$e^{-2\pi s}\sin t$

Q.4(a) Solve the Laplace transformation: $y'' - 3y' + 2y = 2e^{-t}$, $y(0) = 2$, $y'(0) = 1$ 5.67

(b) Solve by using Laplace transformation of the following boundary value problem 6.00

$$\frac{\partial^2 Y}{\partial t^2} = 9\frac{\partial^2 Y}{\partial x^2}, \quad Y(0,t) = 0, \quad Y(2,t) = 0 \quad Y(x,0) = 20\sin 2\pi x - 10\sin 5\pi x.$$

$10\sin 2\pi x\sin 15\pi t - 180\sin 2\pi x.\sin 6\pi t$

SECTION-B

Q.5(a) The first four moments of a distribution about the value 5 of the variable are 2, 20, 40 and 50. Find the mean, variance, M_3, M_4. Comment upon the nature of the curve. 6.00

β_1, β_2, 0.632

$\beta_1 < 0 \rightarrow$ -ve skew

(b) The following are the scores of two batsman A and B in a series of innings: 5.67

A: 15 101 8 80 10 120 35 15
B: 48 10 35 22 50 60 25 34

Who is the better scorer and who is more consistent player?

88.92% 43.57%

Q.6(a) Establish poisson distribution form Binomial distribution. 4.00

(b) 'A' can hit a target 3 times in 5 shots, 'B' can hit 2 in 7 shots and 'C' can hit 3 in 8 shots. All of them then fire one shot each simultaneously at the target. What is the probability that *(i)* at least two shots hit *(ii)* at most 2 shots hit? 4.00

$\frac{3}{8}$, $\frac{121}{140}$

(c) If x denotes the number of heads in a single toss of 4 fair coins, find $p\,(1 < x \leq 3)$ 3.67

Q.7(a) Find the mean and variance of Normal distribution. 5.00

(b) Suppose 3% of bolts made by machine are defective. The defects occurring at random during production. If bolts are packaged 50 per box, find *(i)* exact probability and *(ii)* Poison approximation to it, that a given box will contain 5 defective. 4.00

(c) What do you understand by dispersion? → Theo 2.67

Q.8(a) Define correlation and regression. Obtain the correlation coefficient between the heights of father(X) and son (Y) from the following data: 6.00

X:	65	66	67	68	69	70	71	67
Y:	67	68	64	72	70	67	70	68

0.3628

(b) A skilled typist on routine work kept a record of mistakes made per day during 300 working days. Fit a poisson distribution to the following data: 5.67

Mistakes per day :	0	1	2	3	4	5	6
Number of days:	143	90	42	12	9	[illegible]	1

[illegible] 110 [illegible]

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Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering SECOND year FOURTH SEMESTER Examination, 2011

Math 203
Mathematics-IV

Full Marks: 70 **Time: 3 Hours**

N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1(a) Determine the vector having initial point $P(x_1, y_1, z_1)$ and terminal point $Q(x_2, y_2, z_2)$ and find its magnitude. 3.67

(b) Find the work done in moving an object along a straight line from (3, 2, -1) to (2, -1, 4) in a force field, $\vec{F} = 4i - 3j + 2k$. 4.00

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(c) Prove that (i) $\vec{\nabla} \times (\vec{\nabla}\varphi) = 0$ (ii) $\vec{\nabla}.(\vec{\nabla} \times \vec{A}) = 0$ 4.00

where φ is a scalar function and $\vec{A}$ is a vector function of x, y and z.

Q.2(a) Define line integration. What is the physical interpretation of line integration? If $\vec{F} = (5xy - 6x^2)i + (2y - 4x)j$, evaluate $\int \vec{F}.d\vec{r}$ along the curve C in the xy plane, $y = x^3$ from the point (1, 1) to (2, 8) 6.00

(b) Evaluate $\iint_S (\vec{\nabla} \times \vec{F})\,\vec{n}\,ds$, if $\vec{F} = (x + 2y)i - 3zj + xk$ and S is the surface of 2xy + y + 2z = 6 bounded by x = 0, x = 1, y = 0 and y = 2. 5.67

Q.3(a) Verify the divergence theorem for the vector $\vec{A} = 2x^2y\vec{i} - y^2\vec{j} + 4xz^2\vec{k}$ taken over the region in the first octant bounded by $y^2 + z^2 = 9$ and x = 2. 6.00

(b) Find (i) $L\left\{\frac{e^{[illegible]} - e^{[illegible]}}{t}\right\}$ (ii) $L^{-1}\left\{\frac{s+4}{s^2 + 2s + 7}\right\}$ 5.67

Q.4(a) Solve the differential equation (by Laplace transformation) $\frac{d^2y}{dt^2} + 9y = \cos 2t$ where $y(0) = -3$ and $y'(0) = 5$. 5.67

(b) Using Laplace transformation solve the boundary value problem: $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to $U(x,0) = 3\sin 2\pi x$, $U(0,t) = U(1,t) = 0$ where $0 < x < 1, t > 0$. 6.00

SECTION-B

Q.5(a) State the various types of averages and examine the merits and demerits of each as measure of central tendency. 5.67

(b) The first four moments of a distribution about the value 4 of the variable are -1.5, 17, -30 and 102. Find the moments about mean. Calculate β_1 and β_2 and comments about the shape of the curve 6.00

Q.6(a) A box contains 5 white, 3 black and 6 red balls. If three balls are drawn at random and X denotes the number of black ball, (i) Find the probability distribution table of X and (ii) Present the distribution in a figure. 4.00

(b) A problem of mechanics is given to the three students A, B and C whose chances of solving it are ½, ⅓, and ¼ respectively. What is the probability that the problem be solved if all of them try independently? 4.00

(c) If 20% of the bolts produced by a machine are defective, determine the probability that out of 5 bolts chosen at random at least two will be defective. 3.67

Q.7(a) Assume the mean heights of solders to be 68.22 inches with a variance of 10.8 inch². How many solders in a regiment of 1000 would you expect to be over 6 feet tall? 3.00

(b) Find the mean of the Poisson distribution. 3.00

(c) 255 metal rods were cut roughly six inches over size. Finally the lengths of the average amount were measured exactly and grouped with 1-inch intervals, there being in all 12 groups. The frequency distribution for the 255 lengths was 5.67

Central value, x:	1	2	3	4	5	6	7	8	9	10	11	12
Frequency, f:	2	10	19	25	40	44	41	28	25	13	5	1

Fit a normal distribution to the data.

Q.8(a) Find a least square regression line of x and y of the data 5.67

Height x of father (in.):	[illegible]	63	67	64	68	62	70	66	68
Height y of son (in) :	[illegible]	66	68	65	69	66	68	65	71

(b) Define correlation and regression. Obtain the correlation coefficient between the heights of father (X) and son (Y) from the following data : 6.00

X :	65	66	67	68	69	70	71	67
Y :	67	68	[illegible]	72	70	67	70	68

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DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering SECOND year FOURTH SEMESTER Examination, 2010
Math 203
Mathematics -IV

Full marks: 70 | Time: 3 Hours

N.B:- (i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1(a) Show that the three vectors $\vec{A} = 2\underline{i} + \underline{j} - 3\underline{k}$, $\vec{B} = \underline{i} - 4\underline{k}$ and $\vec{C} = 4\underline{i} + 3\underline{j} - \underline{k}$ are linearly dependent. Determine a relation between them and then show that the terminal points are collinear.. 4.00

78 * (b) Find the equation for the tangent plane to the surface $z = x^2 + y^2$ at the point $(1, -1, 2)$. 3.67

$(r - r_0) \cdot \underline{N} = 0$ $\quad$ $\underline{N} = \nabla\phi$

80 (c) Show that $\vec{A} = (6xy + z^3)\underline{i} + (3x^2 - z)\underline{j} + (3xz^2 - y)\underline{k}$ is an irrotational. Find a scalar function φ such that $\vec{A} = -\vec{\nabla}\varphi$. 4.00

Q.2(a) Evaluate $\int_c \vec{F} \cdot d\vec{r}$ where, $\vec{F} = (2x + y)\underline{i} + (3y - x)\underline{j}$ and c is the curve in the xy plane consisting of the straight lines from $(0,0)$ to $(2,0)$ and then to $(3,2)$. 3.67

(b) Evaluate $\iint_s (\vec{\nabla} \times \vec{F}) \cdot \hat{n}\, ds$ where, $\vec{F} = (x + 2y)\underline{i} - 3z\underline{j} + x\underline{k}$ and s is the surface of $2x + y + 2z = 6$ bounded by $x = 0, x = 1, y = 0$ and $y = 2$. 4.00

(c) State and prove stoke's theorem. 4.00

Q.3(a) If $F(t) = \begin{cases} \cos t & 0 < t < \pi \\ 0 & \pi < t < 2\pi \end{cases}$ 5.67

$t > a$
$t < a$

then find the value of $\mathcal{L}\{F(t)\}$.

(b) Evaluate (i) $\mathcal{L}\left\{\dfrac{e^{-3t} - e^{-6t}}{t}\right\}$ 6.00

(ii) $\mathcal{L}^{-1}\left\{\dfrac{s + 5}{s^2 + 2s + 5}\right\}$

Q.4(a) By Laplace transformation solve the ordinary differential equation $\dfrac{d^2y}{dx^2} + y = e^{x}$, where $y(0) = y'(0) = 0$. 5.67

(b) Solve the partial differential equation $\dfrac{\partial U}{\partial t} = \dfrac{\partial^2 U}{\partial x^2}$, $U(x,0) = 3\sin 2\pi x, U(0,t) = 0, U(1,t) = 0,$ where $0 < x < 1$ by Laplace transformation. 6.00

SECTION – B

Q.5(a) State various types of averages and examine the merits and demerits of each measure of central tendency. 5.00

(b) The mean of two samples of sizes 50 and 100 respectively are 54.4 and 50.3 and the standard deviation are 8 and 7. Obtain the mean and standard deviation of the sample of size 150 obtain by combining the two samples. 3.67

(c) Establish the relation between standard and root mean square deviation. 3.00

Q.6(a) Define probability. Using sample space show that P(A ∪ B) = P(A) + P(B) − P(A ∩ B) 5.67

(b) 'A' can hit a target 3 times in 5 shots. 'B' can hit 2 in 6 shots and 'C' can hit 3 in 7 shots. All of them fire one shot each simultaneously at the target. What is the probability that (i) 2 shots hit (ii) at least two shots hit.

Q.7(a) Find the mean and variance of normal distribution. 5.00

(b) Assume that the probability of an individual coal miner being killed in a mini accident during a year is $\frac{1}{2400}$. Use appropriate statistical distribution to calculate the probability that in a mini employing 2000 miners, there will be at least 2 fatal accidents in a year. 3.00

(c) Find the probability $p(1<x<2)$ of the density function 3.67

$$f(x) = \begin{cases} cx^2; & 0<x<3 \\ 0; & otherwise \end{cases}$$

where x lies between 1 and 2.

Q.8(a) A box contains 7 white and 5 black balls. Another box B contains 7 white and 9 black balls. A ball is transferred from the box B to A then a ball is drawn from box A. Find the probability that is black. 5.67

(b) Fit a normal curve to the following data 6.00

length of line	8.60	8.59	8.58	8.57	8.56	8.55	8.54	8.53
Frequency	2	3	4	9	10	8	4	1