BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Environmental, Water and Coastal Engineering
Student Group : 0 < Earned Credit Hour <= 36, Final Examination (Fall) : Dec 2020

Subject: MATH-109, Differential Equations and Statistics

Total: 2.00 hours **Full Marks: 180**
Section A : 1.00 hour **Section A : 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 1 and Question – 4 (Viva Voce)** in **Section A** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 2 & Q - 3)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.

SECTION-A

Question – 1 (Compulsory)

a. Form a differential equation of which $y = A\cos\alpha x + B\sin\alpha x$, where A and B are arbitrary constants and α is a fixed constant. **12**

b. Solve the following differential equations: **12+12=24**

(i) $(e^x + 1)ydy = (y + 1)e^x dx$

(ii) $\frac{dy}{dx} + \frac{2}{x}y = x\ln x$

Question – 2

a. Solve the differential equation to exact form **12**

$$(x^3 + 3xy^2)dx + (y^3 + 3x^2y)dy = 0.$$

b. Solve the differential equation $y = px + \frac{a}{p}$ and find it's singular solution. **12**

c. Solve: $(D^2 + 5D + 4)y = 3 - 2x.$ **12**

Question – 3

a. Solve: $(x^2D^2 - xD + 1)y = 2\ln x$ **12**

b. Define partial differential equation. Form a partial differential equation by eliminating a, b, c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$. **2+10=12**

c. Solve the following PDE: $x^2p + y^2q = z^2$ **12**

Question – 4 Viva Voce (Compulsory) **18**

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Total: 2.00 hours **Full Marks: 180**
Section B : 1.00 hour **Section B : 90**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question – 5 and Question – 8 (Viva Voce)** in **Section B** are compulsory.
c. Answer any **OTHER ONE** question from this section **(From Q - 6 & Q - 7)**.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** used have their usual meanings.
g. **z – table** attached.

SECTION-B

Question – 5 (Compulsory)

a. What is Lorenz curve? What are the use of Lorenz curve? **07**

b. The mean and standard deviation of a set of 100 observations were worked out as 40 and 5 respectively by a computer which by mistake took the value 50 in place of 40 for one of the observations. Find correct mean and variance. **12**

c. From the following data, calculate first four moments and also find the value of γ_1. **17**

Monthly profit (in lakh tk)	No of Companies
50-70	4
70-90	8
90-110	12
110-130	20
130-150	6
150-170	7
170-190	3

Question – 6

a. Explain conditional probability and Baye's Law. **06**

b. A box contains 10 white, 7 black and 3 green balls. 2 balls are drown at random. Determine the probability that (i) 1 is black and 1 is green. (ii) both are of same color. (iii) both are of different colors. **12**

c. A manufacturing firm produces steel pipes in plants A, B, C with daily production volume $1000, 1500$ and 500 units respectively. According to past experience, it is known that the fractions of defective output produced by the three plants are respectively at random $0.005, 0.008$ and 0.010. If a pipe is selected from a days total production and found to be defective, find out **18**

(i) Which plant has highest probability for this defective pipe.

(ii) What is the probability that it came from the first plant?

Question – 7

a. Define Poisson distribution. What are the uses of poisson distribution? **06**

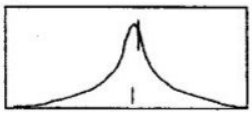
b. On the average, one in 400 items is defective. If the items are packed in boxes of 100, what are the probabilities that any given box of items will contain: **12**

(i) No defectives;
(ii) One or more defectives;
(iii) More than three defectives?

c. If a college admission test are normally distributed with an average 400 and S.D. 100 **18**

(i) What percentage of the people taking test score between 350 and 450?
(ii) A student got a score of 600. What percentage of the people taking the test score better? What percentage are worse?
(iii) If qualifying score is 450, what percentage of the students taking the test would be acceptable to the college?

Question – 8 Viva Voce (Compulsory) **18**



Area Under the Standard Normal Curve

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2342	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3558	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4619	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990