TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MECHANICAL, ELECTRICAL, BUILDING AND CIVIL ENGINEERING

YEAR 3 SEMESTER I

AMA 2350: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2HOURS

DATE: Pick Date December 2016

Question One (30 Marks)

a) Outline TWO advantages and TWO disadvantages of using secondary data in a research

(4 Marks)

b) Given below is a frequency distribution

Class	Frequency
16 – 20	10
21 – 25	15
26 – 30	17
31 – 35	3

From the distribution calculate:

i) Range *(2 Marks)*
ii) 3rd quartile *(3 Marks)*
iii) 70th percentile *(3 Marks)*

c) Explain the following events in probability

i) Favourable events
ii) Equally likely events
iii) Mutually exclusive events

(3 Marks)

d) In how many ways can the following be done:
   i) Seating 5 passengers on 14 available seats of a matatu
   ii) Nominating the president, secretary and treasurer of an association at random out of 120 members.

(4 Marks)

e)
   i) Determine using Pascal's triangle method the expansion of

   $(2p - 3q)^5$

(3 Marks)

   ii) Evaluate $(0.97)^6$ correct to 4 significant figures using binomial expansion

   (4 Marks)

f) A variable has been established to follow the standard normal distribution. Determine the probability that a value for this variable will lie
   i) Between 0 and 1.9
   ii) Between -1.2 and 2.3

(4 marks)

Question Two (20 Marks)

a) The following is electricity consumption (in Kilo-watt-hours) of sampled households in a small town.

24	26	28	32	37	5	1	7	9	11	15	13	14	18
29	31	32	6	4	2	9	18	27	36	3	9	15	21
27	33	4	8	12	16	20	5	10	3	8	1	6	4
9	2	7	12	18	27	23	21	29	22	15	17	28	10

   i) From the raw data shown above form a frequency distribution taking class width of 7 using inclusive type classes
      (5 marks)

      Hence calculate the following values of the electrical consumption:
   ii) The mean value   (3 marks)
   iii) The median value   (4 marks)
   iv) Standard deviation   (4 marks)

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v) Coefficient of skew (2 marks)

vi) From the value obtained in (v) above sketch the graph of skewness
(2 marks)

Question Three (20 Marks)

a) A random variable X is defined as the number of heads in simultaneous toss of three coins.
   i) Obtain the probability distribution of X
   ii) Calculate expected value (mean) of X
   iii) Variance of X

(8 Marks)

b) A variable is normally distributed with mean of 500. In the past it has been established that 15% of the variable values fall below 475. Determine percent of the values will lie:
   i) Between 485 and 515 (8 Marks)
   ii) Below 510 (4 marks)

Question Four (20 Marks)

a) Asha and Kazungu appear in an interview for two vacancies in the same post. The probability of Asha's selection is $\frac{1}{7}$ and that of Kazungu's selection is $\frac{1}{5}$. If their selection is independent of each other what is the probability that:

   i) Both of them will be selected?
   ii) None of them is selected?

(4 Marks)

b) If the chance that a vessel arrives safely at a port is $\frac{9}{10}$, use the Binomial distribution to determine the chance that out of 5 vessels expected at the port, at least 4 will arrive safely.

(5 Marks)

c) The average number of defective articles in a factory is claimed to be less than the average for all the factories. The average for all the factories is 30.5. A random sample of 100 defective articles showed the following distribution

Class limits	Number
16 – 20	12
21 – 25	22
26 – 30	20
31 – 35	30
36 – 40	16

   i) Calculate the mean and standard deviation for the sample

(4 Marks)

ii) Use the result obtained in (i) above to test the claim that the average is less than the figure for all the factories at 5% level of significance.

(7 Marks)

Question Five (20 Marks)

a) A survey conducted by a Scandinavian country over the past 25 years indicated that in 10 years the winter was mild, in 8 years it was cold and in the remaining 7 years it was very cold. A company sells 1000 woollen coats in mild year, 1300 in a cold year and 2000 in a very cold year. Determine the expected yearly profit of the company if a woollen coat costs $173 and it is sold to stores for $248.

(7 Marks)

b) From a random sample of 38 Mombasa county civil service personnel, the mean age and the sample standard deviation were found to be 41 years and 4.3 years respectively. Construct a 95 per cent confidence interval for the mean age of civil servants in Mombasa county.

(6 Marks)

c) If 5% of the electric bulbs manufactured by a company are defective, use Poisson distribution to find the probability that in a sample of 100 bulbs
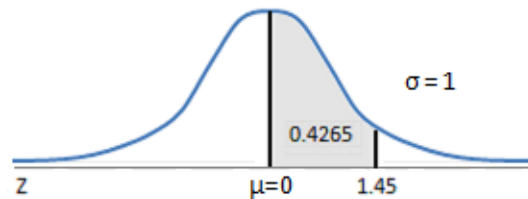   i) One is defective (4 Marks)
   ii) 5 bulbs will be defective (3 Marks)

Areas Under the One-Tailed Standard Normal Curve

This table provides the area between the mean and some Z score. For example, when Z score = 1.45 the area = 0.4265.

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	0.2642	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	0.3577	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	0.4649	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
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000