FACULTY: ENGINEERING

FIRST SEMESTER EXAMINATIONS

2016/ 2017 ACADEMIC SESSION

HOD'S SIGNATURE

COURSE CODE: GNE 415

COURSE TITLE: ENGINEERING ANALYSIS – 3 UNITS

DURATION: 2 HOURS 30 MINUTES

INSTRUCTIONS

1. ATTEMPT ANY **FOUR** QUESTIONS OF YOUR CHOICE
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM
3. YOU ARE NOT ALLOWED TO BORROW CALCULATORS AND ANY OTHER WRITING MATERIALS

Question 1 (25 MARKS)

The following are the age (in years) and systolic blood pressure of 20 apparently healthy adults.

Age(x)	20	43	63	26	53	31	58	46	58	70	46	53	60	20	63	43	26	19	31	23
B.P(y)	120	128	141	126	134	128	136	132	140	144	128	136	146	124	143	130	124	121	126	123

(a) Find the correlation between age and blood pressure using simple correlation coefficient, and comment.

(b) Find the regression equation?

(c) What is the predicted blood pressure for a man with age 25 years?

Question 2 (25 MARKS)

(a) State the conditions for analyticity of a complex function.

(b) Determine the analyticity of the following complex functions

(i) $f(z) = z^4$ (ii) $f(z) = iz\bar{z}$

(c) Let $w = f(z) = 5z^2 - 12z + 3 + 2i$. Find Real f,(u) and Imaginary. f(v) and calculate the value of f at $z = 4 - 3i$

Question 3 (25 MARKS)

(a) Use the Laplace transform to solve each of the following differential equations

(i) $f'(x) + f(x) = 3 \quad where\ f(0) = 0$

(ii) $f''(x) + 3f'(x) + 2f(x) = 4x \quad where\ f(0) = f'(0) = 0$

(b) Find the Inverse Laplace transform of each of the following

(i) $F(s) = -\frac{3}{4s}$ (ii) $F(s) = \frac{1}{2s-3}$

(c) Find the Fourier transform of a rectangular pulse: $f(t) = 1, \quad -T \leq t \leq T$

Question 4 (25 MARKS)

(a) *Using Lyapunov function,* $V(x,y) = x^2 + y^2$ *Determine the stability of the systems*

(i) $\dot{x} = -4y + 2xy - 8$ (ii) $\dot{x} = y - x^2 + 2$

$\dot{y} = 2x^2 - 2xy$ $\dot{y} = 4y^2 - x^2$

(b) Solve the following non-linear differential equations using method of separation of variables

(i) $\frac{dy}{dx} = \frac{y^2+xy^2}{x^2y-x^2}$ (ii) $xy\frac{dy}{dx} = \frac{x^2+1}{y+1}$

(c) State three (3) applications of probability

Question 5 (25 MARKS)

(a) Determine the probability that a random value z lies between $z = -1.4$ and $z = 0.7$ as shown in fig. Q5 below.

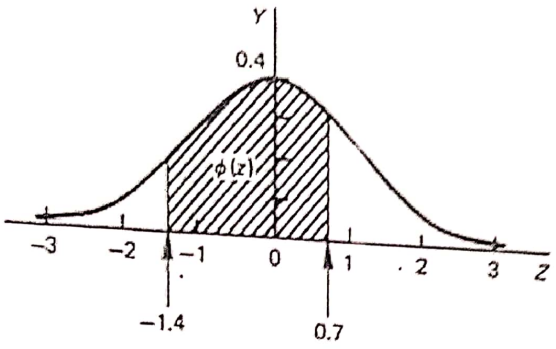

Fig. Q5

(b) Assuming that telephone calls from an office in Elizade University are monitored and found to have a mean duration of 452 seconds and a standard deviation of 132 seconds. Determine the probability of the length of a call being between 300 seconds and 480 seconds

(c) Let X be a discrete random variable with range $R_x = \{1,2,3 \ldots.\}$ *Suppose X is given by*

$$P_X(k) = \frac{1}{2^k} \quad for\ K = 1,2,3$$

(i) Find $P(2 < X \leq 5)$ (*ii*) Find $P(X > 4)$

LIST OF RELEVANT FORMULAS

Simple Correlation Coefficient, $$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right).(\sum y^2 - \frac{(\sum y)^2}{n})}}$$

Regression equation; $$\hat{y} = \bar{y} + b(x - \bar{x}),\ \ Where,\ b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

Table Q5

z_1	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	0·4773	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	0·4983	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	0·4989	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