Tanta University

Department: Elec. Power and Machines Engineering
Total Marks: **120 Marks**

Faculty of Engineering

Course Title: Electrical Machines (2)	Course Code: EPM3111	Year: 3rd
Date: Jan. 10th 2013 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data… answers should be supported by sketches if possible)

Question number (1) **(30 Marks)**

a) **What** is a transformer? **Can** it be used to transform direct voltage and direct current? **Why**? **(4 Marks)**

b) **What** differentiate a core-type transformer from a shell-type transformer? **(4 Marks)**

c) The following data were obtained for a 20 KVA, 60 Hz, 2400/240 V single-phase distribution transformer tested at 60 Hz:
With high-voltage winding open circuited: 240 V, 1.038 A, 122 W
With low-voltage terminals short-circuited: 61.3 V, 8.33 A, 257 W

(i) **Discuss briefly** the necessary conditions required to perform each test.

(ii) **Derive** an approximate equivalent circuit referred to the high voltage side

(iii) If the transformer delivers 90% of the rated load at 220 V and 0.8 lagging power factor, **determine** the voltage regulation and the efficiency.

(iv) **Draw** the phasor diagram for condition (iii) **(22 Marks)**

Question number (2) **(30 Marks)**

a) A single-phase, 12 kVA, 2400/240, 60 Hz distribution transformer has the following characteristics **at half load**: Core loss = 100 W and copper loss = 50 W

(i) **Determine** per-unit rating at which the transformer efficiency is a maximum. **Determine** this efficiency if the load power factor is 0.9.

(ii) Determine the all-day efficiency of the transformer if it has the following load cycle.

No load for 6 hours ** 75 % full load for 10 hours at 0.9 PF ** 90% full load for 8 hours at 0.8 PF **(10 Marks)**

b) A 5000-VA, 480/120 V conventional transformer is to be used as an autotransformer to supply power from a 480 V source to a 600 V load.

(i) **Explain briefly** the advantages and drawbacks of the autotransformer.

(ii) **Sketch** the transformer connection that will do the required job.

(iii) **Determine** the kVA rating of the autotransformer.

(iv) **Derive** an expression for the per-unit series impedance of an autotransformer as a function of that of the conventional transformer. **(12 Marks)**

c) **Give short notes** on the main features of the following:

(i) Instrument transformers.

(ii) Transformer inrush current. **(8 Marks)**

Question number (3) **(34 Marks)**

a) A three-phase transformer bank is to handle 650 kVA and have a 66/13.8 kV voltage ratio.

(i) **Find** the rating of each individual transformer in the bank (high voltage, low voltage, turns ratio and apparent power) if the transformer bank is connected as: Δ-Y and Δ-Δ.

(ii) **Explain briefly** the applications, advantages and drawbacks of each connection.

(iii) **Explain why** the open-Δ transformer connection is limited to supplying 57.7 percent of a normal Δ-Δ transformer bank's load. **(12 Marks)**

b) A three-phase, 230 V, 25 kVA, 0.8 PF (lag) load is supplied by three 10 kVA, 2300/230 V, 60 Hz transformers connected in Y-Δ. The equivalent impedance of one transformer referred to low-voltage side is $0.12+j0.25\ \Omega$.

(i) **Determine** the required supply voltage if the load voltage is 230 V.

(ii) **Repeat (i)** using the per-unit system. **(8 Marks)**

c) A 75 kVA, 60 Hz, 4800/482 transformer A is connected in parallel with a 60 kVA transformer B whose exact ratio is unknown. The transformers are operating in the step-down mode and have a circulating current of $\mathbf{37.32\angle -63.37^{o}}$ A. the respective impedances as determined from a short-circuit test and referred to the low side are $\mathbf{Z_{eq,A} = 0.0799\angle 62^{o}\ \Omega}$ and $\mathbf{Z_{eq,B} = 0.0676\angle 65^{o}\ \Omega}$.

(i) **Determine** the voltage ratio of transformer B.

(ii) **If** transformer B has a similar voltage ratio of transformer A, **can** the bank be operated at its combined rating of 135 kVA without overheating? ***Show all work***. **What** is the new value of the circulating current?

(iii) **Discuss briefly** the conditions of paralleling:

- two single-phase transformers - two three-phase transformers

(14 Marks)

Question number (4) **(26 Marks)**

a) **Derive** an expression for the output equation of a three-phase transformer. **(6 Marks)**

b) A 5 kVA, 11000/400 V, 50 Hz, single phase core type distribution transformer has the following design data: The net conductor area in the window is 0.5 times the net cross-section area of iron in the core, a maximum flux density 0.9 wb/m^2, a current density 1.5 A/mm^2, stacking factor 0.88, window space factor 0.22 and the height of window is 2.8 times its width. *Assume a square cross-section for the core.*

(i) **Discuss briefly** the factors affect the choice of flux density and current density of a transformer.

(ii) **Determine** the main dimensions of the core, the number of turns and the cross-section area of the conductors. **(20 Marks)**

WISH YOU ALL THE BEST

Dr. Said M. Allam

Tanta University | Department: Elec. Power and Machines Engineering | Faculty of Engineering

Total Marks: 70 Marks

Course Title: High Voltage Engineering	Course Code: EPM3112	Year: 3rd
Date: 13 Jan 2013 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Answer the following questions:

Question (1) (17 Marks)

a) Show schematically the variation of current with the applied voltage into a gas gap as described by Townsend. Then, derive Townsend expression for current growth. What is the condition of breakdown according to this mechanism? (5 Marks)

b) Plot the graphical representation of Paschen's law. Explain the physical mechanisms in the different regions of the graph. (4 Marks)

c) Compare between breakdown voltage of a gas gap under high voltage DC, under high voltage AC and under impulse voltages. (3 Marks)

d) The first ionization coefficient for a non uniform field is $\alpha = 15000x\ m^{-1}$. If 100 electrons start at the cathode surface, find the distance at which the avalanche will be developed to a streamer. Streamer condition occurs when the number of electrons at the avalanche head reaches 10^8. (3 Marks)

e) Complete the following sentences: (2 Marks)

1. In the case of photo-ionization, the shorter wavelength of radiation (***increases – decreases – doesn't affect***) the probability of breakdown.
2. For breakdown in gases, the critical frequency is defined as .....

Question (2) (17 Marks)

a) Compare with only sketches between cavity theory and suspended particle theory as breakdown mechanisms in liquid dielectrics. (4 Marks)

b) In an experiment for determining the breakdown strength of transformer oil, the following observations were made.

Gap spacing (mm)	4	6	10	12
Breakdown voltage (kV)	90	140	210	255

Determine the power law dependence between the gap spacing and the applied voltage for the oil. (3 Marks)

c) A solid dielectric has a relative permittivity of 4, a young's modulus of $10^5\ kg/cm^2$ and tan δ of 0.001 is subjected to an alternating voltage at a frequency of 50 Hz. If the heat dissipated is $1\ W/cm^3$ and the applied electric field is 5 MV/cm, which mechanism of breakdown is expected? (3 Marks)

d) Describe the electrical discharge phenomenon inside a void in solid dielectrics under alternating voltages. Draw the equivalent circuit and the discharge pattern. What discharge pattern do you expect if the alternating voltage is replaced by a high voltage DC? (5 Marks)

f) Complete the following sentences: (2 Marks)

1. The volume which is contained between the maximum stress E_{max} contour and 0.9 E_{max} contour is called .....
2. Electric field corresponding to electrochemical breakdown in solid dielectrics is (***near to – lower than – higher than – not related to***) intrinsic breakdown field.

Question (3) (18 Marks)

a) The total voltage ripple of a Cockcroft-Walton type voltage multiplier is 20 kV at a supply frequency of 90 Hz. If the load current is 2.5 mA and the circuit capacitances is 0.05 μf, calculate the number of stages and the percentage regulation. Also, calculate the maximum secondary voltage of the supply assuming that the optimum number of stages for minimum voltage drop is 18 stages. (4 marks)

b) The input voltage to a 80 kVA, 400 V/150 kV testing transformer is 120 V. The transformer has a resistance and a leakage reactance of 0.01 p.u. and 0.06 p.u respectively, on 80 kVA base. If the charging current of the cable at 60 Hz is 450 mA and the added inductance is 150 H, find the voltage at which the cable is tested. What is the required inductance to be added to minimize the input voltage? What is this voltage? Assume that the testing voltage is maintained as the initial case. (4 marks)

c) Draw the equivalent circuit of Tesla coil. What is the needed condition for frequency tuning? (3 marks)

d) Explain how to control the waveshape of an impulse generator and then, draw a 3-stage Marx impulse generator. (4 marks)

e) Complete the following sentences: (3 Marks)
1- The voltage efficiency of an impulse generator is given by .....
2- The types of potential dividers that can be used in the case of impulse wave with high voltage magnitude are ..... and .....

Question (4) (18 Marks)

a) Describe with equations how can you avoid the frequency dependence of the voltage ratio a in resistive potential dividers. Then, mention two sources of errors in high voltage measurements. (4 Marks)

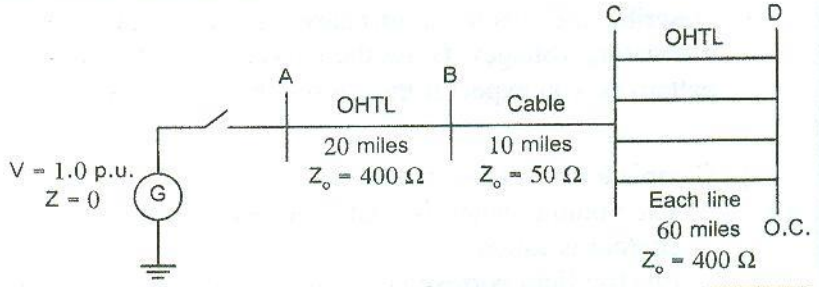
b) A high-voltage, 50 Hz AC signal with a superimposed DC component was measured by a peak voltmeter, an electrostatic voltmeter and a sphere gap. The reading of the peak voltmeter was 40 kV and the reading of the electrostatic voltmeter was 30 kV. The sparkover voltage of the sphere gap under standard conditions is found to be 54 kV. Find the operating temperature if the pressure was kept at 747 mm Hg. Use the following relation between correction factor k and air density factor δ:

δ	0.70	0.75	0.8	0.85	0.9	0.95	1.0	1.05	1.10
k	0.72	0.77	0.82	0.86	0.91	0.95	1.0	1.05	1.09

(4 Marks)

c) Mention three drawbacks for spark gap arresters. Then, describe in brief another type of arresters that can overcome these drawbacks. (3 Marks)

d) For the system shown, the propagation time in the OHTL is 5.38 μs/mile and in the cable is 10.76 μs/mile. Plot the voltage versus distance AD at 376.6 μs. (7 Marks)



Good Luck ---------- Dr. Diaa-Eldin Mansour

Tanta University | Department: Elec. Power and Machines Engineering | Faculty of Engineering
Total Marks: 90 Marks

Title: Generation and economy of electrical energy	**Course Code: EPM3110**	**Year: Third year**
Date: January 17th 2012 (First term)	**Allowed time: 3 hrs**	**No. of Pages: (2)**

الإمتحان مكون من ٣ أسئلة فى صفحتين

Problem number (1) (25 Marks)

a) A generating station has a maximum demand of 25MW, a load factor of 60%, a plant capacity factor of 50% and a plant utilization factor of 72%. Find (i) the plant reserve capacity (ii) the daily energy produced and (iii) maximum daily energy that could be produced if the plant were fully loaded while running as per schedule. (10 points)

b) Choose the best answer: (5 points)

(i) The units covering the base load operate:
(1) when required (2) intermittently (3) continuously (4) all the above

(ii) The main power stations in Egypt are:
(1) thermal and nuclear (2) thermal and hydraulic
(3) hydraulic and nuclear (4) nonconventional power plants

(iii) Local shortage in the generated power is caused due to:
(1) Load shedding (2) underestimating the load demand
(3) outage of a generator (4) outage of a transmission line

(iv) Cold reserve is obtained from some units that are:
(1) reserved for service but are not available in the immediate loading
(2) reserved for service and available in the immediate loading
(3) already in service but are not available in the immediate loading
(4) already in service and available in the immediate loading

(v) Reserve power cannot be highly increased due to:
(1) Technical reasons (2) environmental reasons
(3) economic reasons (4) all the above

c) An oil immersed transformer has an initial cost of 450000 L.E. and a salvage value of 50000 L.E. at the end of the 22nd year. Using the sinking-value method of depreciation, calculate the estimated equipment value after 10 years. Take the annual rate of interest as 5%. (10 points)

Problem number (2) (35 Marks)

a) The input fuel in ($/h) for 3 generating units are given by: $F_1 = 45 + 6P_1 + 0.08P_1^2$, $F_2 = 60 + 5P_2 + 0.1P_2^2$ and $F_3 = 100 + 8P_3 + 0.05P_3^2$. Given that the load demand is 1000 MW and the power limits are: $150 \le P_1 \le 450$, $250 \le P_2 \le 800$, $200 \le P_3 \le 600$, find the optimal incremental fuel cost and the optimal allocation of load between the three units. (10 points)

b) Discuss **one** tariff method for electrical energy that is suitable for industrial loads and **one** tariff method for electrical energy that is suitable for commercial loads and explain the reason of your choice. (10 points)

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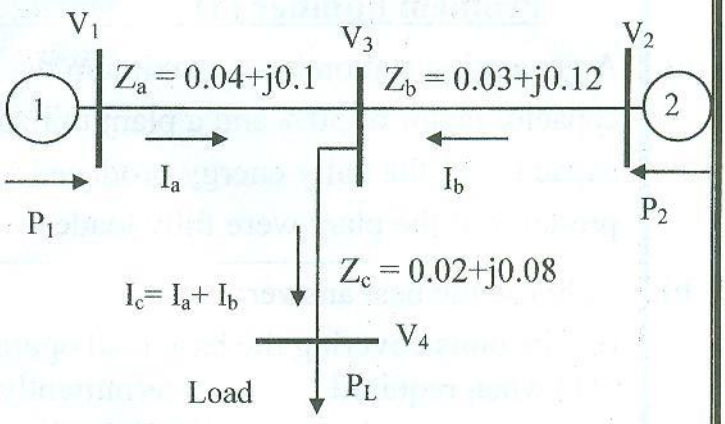
c) For the network shown, the impedances are given in per unit. The voltage at node 3 is: $V_3 = 1.0\angle 0\ p.u.$ and the generator currents in p.u. are: $I_a = 1.0\angle -20$ and $I_b = 0.85\angle -10$ Calculate the coefficients of the loss formula and derive the loss equation using the exact formula. Assuming incremental fuel costs for the generators as: $\frac{dF_1}{dP_1} = 0.012\,P_1 + 3$ and $\frac{dF_2}{dP_2} = 0.02\,P_2 + 2$, and minimum and maximum loads on each unit as 200 and 650 MW, find the incremental fuel cost of the plant and the optimal allocation of load between the two units for a load of 1000 MW. Take the base power as 1000 MW. Assume a tolerance of 1%. Start with a lambda factor of 6 and unity penalty factors. (15 points)



Problem number (3) (30 Marks)

a) Discuss in detail the main tasks of Superheaters, reheaters, Economizer and air preheaters in steam power plants. (8 points)

b) A hydraulic power plant operates at a head of 50m. If the generator efficiency is 95%, calculate the extracted power at a water flow rate of 500 m^3/s. Assume that the specific weight of water is 1000 kg/m^3. (7 points)

c) Aided with net sketches, describe the main parts of nuclear reactor. (7 points)

d) Discuss the operation principles of fuel cells. Mention the main advantages of this kind of energy sources. (8 points)

Good Luck

Course Examination Committee

Dr. Ahmed Refaat Dr Fayza Saafan

Dr. Said Allam

	Final Exam **1st Semester**
Department:**Power Engineering and Electrical Machines**	
Duration: **3Hours**	Date: **20th Jan., 2013**
Course Title: **CCE3170 Automatic Control Principals**	
Instructor:**Dr Ahmed A. Ramadan**	Total Marks: **85**

Instructions to Students

- *You should attempt all questions.*
- *The exam questions are only 4questions.*
- *The allocation of marks is shown in brackets by the questions.*
- *You must show all of your work -- partial credit may be given to partially correct answers, while answers with no justification may not receive full points.*
- *Answer all the parts of a question in sequence.*

[Turnover only when instructed to do so]

Problem (1) (18 Marks)

A common actuator in control systems is the DC motor. It directly provides rotary motion and, coupled with wheels or drums and cables, can provide translational motion. The electric equivalent circuit of the armature and the free-body diagram of the rotor are shown in Fig.1

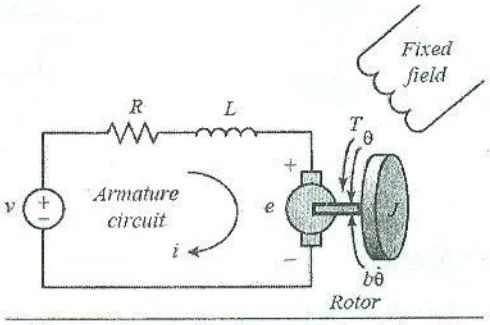


Fig. 1: Schematic diagram of problem 1

Assume the following values for the physical parameters. These values were derived by experiment from an actual motor.

(J)	moment of inertia of the rotor	3.2284E-6 kg.m^2
(b)	motor viscous friction constant	3.5077E-6 N.m.s
(K_b)	electromotive force constant	0.0274 V/rad/sec
(K_t)	motor torque constant	0.0274 N.m/Amp
(R)	electric resistance	4 Ohm
(L)	electric inductance	2.75E-6H

a) Write the system equations **(4Marks)**

b) Represent the equations of part "a" using block diagram while indicating the signals of current i, angular velocity $\dot{\Theta}(t)$, and angular position $\Theta(t)$ **(5Marks)**

c) Find the transfer function relation between the control input $v(t)$ and the angular position $\Theta(t)$ **(4Marks)**

d) Drive a state-space representation using current $i(t)$, angular velocity $\dot{\Theta}(t)$, and angular position $\Theta(t)$ as the states of the system **(5Marks)**

Problem (2) (20 Marks)

a) For the block diagram given in Fig.2 **(10Marks)**

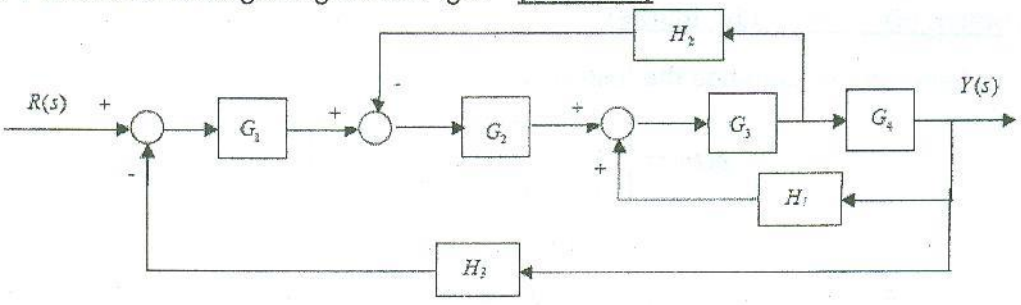


Fig. 2: Block diagram of problem 2-a

i- Using block diagram reduction rules, find the transfer function $Y(s)/R(s)$

ii- Check your answer using signal flow graph technique **(5 Marks)**

b) For the unity feedback control system with minor feedback loop, shown in Fig. 3.

i- In the absence of derivative feedback (a = 0), what is the damping ratio, natural frequency, and steady-state error for unit ramp input. **(4Marks)**

ii- Determine the derivative feedback constant "a" which will increase the damping ratio to 0.7. What is the steady-state error for this value of "a".

iii- Explain how can the steady-state error reduced to the value of part "i" while the damping ratio is maintained at 0.7 **(2 Marks)**

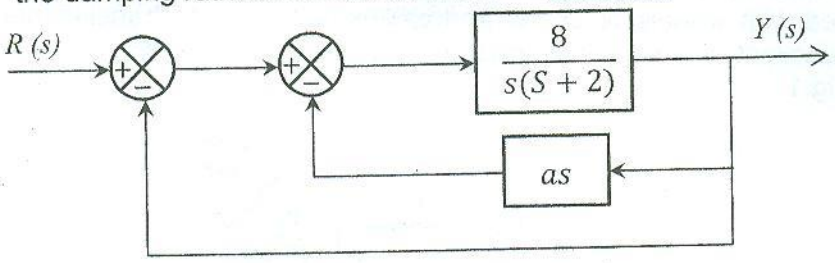


Fig. 3: Block diagram of problem 2-b

Problem (3) **(17 Marks)**

A unity feedback control system is shown in Fig. 4.

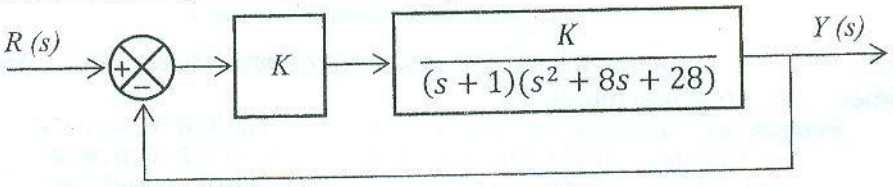


Fig. 4: Block diagram of problem 3

a) Sketch the root locus for the system as K varies from 0 to ∞. **(14Marks)**
b) Calculate the gain value K corresponding to damping ratio 0.5 **(3Marks)**

Problem (4) **(14 Marks)**

A unity feedback control system has an open loop transfer function.

$$GH(s) = \frac{0.5}{s(1 + 0.25s)(1 + 0.05s)}$$

a- Draw the Bode diagramsfor the system. **(10Marks)**
b- From the bode diagrams, determine the Gain Margin GM, Phase Margin PM, the phase crossover frequency w_{pc}, and the gain crorssover frequency w_{gc}. **(4Marks)**

Problem (5) **(16 Marks)**

A tele-robot system has the following state-space equations:

$$\dot{x}(t) = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} u(t)$$

$$y(t) = [1 \quad 0 \quad 2]\, x(t)$$

- Find the system characteristic equation and determine the stability. **(4 Marks)**
- Calculate the state-transition matrix Φ(t) **(4 Marks)**
- Check the system state controllability. **(4 Marks)**
- Check the system state observability. **(4 Marks)**

Good Luck

Dr. Ahmed A. Ramadan

Tanta University

Physics & Engineering Mathematics Department
Total Marks: 70 Marks

Faculty of Engineering

Course Title: Engineering Mathematics (4) Course Code PME3114 Date: 22/1/2013 Allowed time: 3 hrs
Year: Third year Electrical Power and Machines Engineering No. of Pages: 2

Remarks: (Answer the following questions. Assume any missing data…)

Problem number (1) (17 Marks)

(a) Twenty random problems were solved using the hybrid algorithm, the times to solution in seconds are listed. Describe the data set using graphical descriptive technique.

2.045	1.055	0.136	1.894	0.375	2.136	0.336	0.258	1.070	0.506
0.361	7.71	3.579	1.267	0.567	3.888	2.554	4.6	1.3046	3.209

(b) Seven applicants have applied for two jobs. How many ways can the jobs be filled if:
(i) the first person receives a higher salary then second? (ii) no difference between the job?

(c) Prove that if A and B are two independent events, then A^C *and* B^C are also independents.

(d) A quality control inspect has ten assembly lines from which to choose products for testing. Each morning of a five – day week, she randomly selects one of the lines to work on for the day. Find the probability that a line is chosen more once during the week.

Problem number (2) (20 Marks)

(a) If the probability of producing a defective screw is 0.01, what is the probability that a lot of 100 screws will contain more than 2 defectives ?

(b) It is found that in manufacturing a certain article, defects of one type occur with probability 0.15 and defects of a second type with probability 0.1. Assume independence between types of defects, what is the probability that: (i) an article does not have both kinds of defects?
(ii) an article is defect? (iii) an article has only type of defect given that it is defect?

(c) An important component of a personal computer (PC) is a microchip. The percentages of microchips that a certain manufactures purchases from 3 suppliers are 35%, 25% and 40%. Suppose the defective microchips produced by the three suppliers are 0.01, 0.03 and 0.06 respectively. If a single PC microchip failure is observed, what is the probability that it is from the third supplier?

(d) Given that X has the probability distribution $f(x)=\frac{1}{8}\binom{3}{x}, x=0,1,2,3$. Find the moment generating function to this random variable and use it to determine μ *and* σ.

Problem number (3) (18 Marks)

(a) Suppose that in an automatic process of filling oil into cans, the content of a can (in gallons) is Y= 50+X. Where X is a random variable with density $f(x)=1-|x|$ *when* $|x|\le 1$ *and zero for* $|x|>1$. Sketch $f(x)$ *and* $F(x)$. In a lot of 100 cans, about how many will contain 50.1 gallons or more? What is the probability that a can contain less than 49.5 gallons?

(b) An electrical current travelling through a resistor may take one of three different paths $y_i, i=1,2,3$ with probabilities $p_1=0.25$, $p_2=0.30$ *and* $p_3=0.45$ respectively. Suppose we monitor the path taken in ten trails. Find (i) $E(y_3)$ *and* $V(y_2)$. (ii) the probability that the current will travel the paths $y_1=2$, times, $y_2=4$ times and the third path $y_3=4$ times.

(c) The amount of a chemical compound Y dissolved in 100 grams of water at various temperatures X was recorded as follows:

Temperature X	15	30	45	60	12	44	48
Converted sugar Y	10	21	33	39	14	42	44

(ii) Compute r and discuss its value (ii) Find the linear prediction equation and predict Y(65).

P.T.O. For Continue

Problem number (4) **(15 Marks)**

(a) Specifications for certain job call for bolts with a diameters of $0.280 \pm 0.001\,cm$. If the diameters of the bolts made by some manufacturer are normally distributed with $\mu = 0.279$ and $\sigma = 0.001$, what percentage of these bolts will meet specifications.

(b) The brightness of a television picture can be evaluated by measuring the amount of current required to achieve a particular brightness level. A sample of 10 tubes results in $\bar{x} = 317.2$ and $S = 15.7$. Find (in micro amps) a 99% confidence interval on mean current required.

(c) An electron firm manufactures light bulbs that have length of life that is approximately normally distributed. If a sample of 30 bulbs has an average life of 780 hours and standard deviation of 38 hours. Find a 96% confidence interval for the population variance.

Best wishes Dr. Manal Mohamed Hekal

Table I : T. distribution

F(t)	0.9	0.95	0.975	0.99	0.995	0.999	
df							df
1	3.078	6.314	12.706	31.821	63.656	318.289	1
2	1.886	2.920	4.303	6.965	9.925	22.328	2
3	1.638	2.353	3.182	4.541	5.841	10.214	3
4	1.533	2.132	2.776	3.747	4.604	7.173	4
5	1.476	2.015	2.571	3.365	4.032	5.894	5
6	1.440	1.943	2.447	3.143	3.707	5.208	6
7	1.415	1.895	2.365	2.998	3.499	4.785	7
8	1.397	1.860	2.306	2.896	3.355	4.501	8
9	1.383	1.833	2.262	2.821	3.250	4.297	9
10	1.372	1.812	2.228	2.764	3.169	4.144	10
11	1.363	1.796	2.201	2.718	3.106	4.025	11
12	1.356	1.782	2.179	2.681	3.055	3.930	12
13	1.350	1.771	2.160	2.650	3.012	3.852	13
14	1.345	1.761	2.145	2.624	2.977	3.787	14
15	1.341	1.753	2.131	2.602	2.947	3.733	15
16	1.337	1.746	2.120	2.583	2.921	3.686	16
17	1.333	1.740	2.110	2.567	2.898	3.646	17

Table II values of chi-squared

df	Values of Chi-squared					
	0.01	0.025	0.05	0.95	0.975	0.99
18	7.01	8.23	9.39	28.87	31.53	34.81
19	7.63	8.91	10.12	30.14	32.85	36.19
20	8.26	9.59	10.85	31.41	34.17	37.57
21	8.90	10.28	11.59	32.67	35.48	38.93
22	9.54	10.98	12.34	33.92	36.78	40.29
23	10.20	11.69	13.09	35.17	38.08	41.64
24	10.86	12.40	13.85	36.42	39.36	42.98
25	11.52	13.12	14.61	37.65	40.65	44.31
26	12.20	13.84	15.38	38.89	41.92	45.64
27	12.88	14.57	16.15	40.11	43.19	46.96
28	13.56	15.31	16.93	41.34	44.46	48.28
29	14.26	16.05	17.71	42.56	45.72	49.59
30	14.95	16.79	18.49	43.77	46.98	50.89
35	18.51	20.57	22.47	49.80	53.20	57.34
40	22.16	24.43	26.51	55.76	59.34	63.69
45	25.90	28.37	30.61	61.66	65.41	69.96
50	29.71	32.36	34.78	67.50	71.42	76.15

TABLE III

Standard Normal Distribution

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952

Course Title: Communication systems	Course Code: EEC31**	Third Year
Date: 24-1-2013 (first term)	Allowed time: 3 hrs	No. of Pages: (2)

Answer all the following questions:

Question (1) (10 degrees)

(1) Evaluate the trigonometric Fourier series of the waveform shown in Figure (1).

$$g(t) = \sin(t)$$

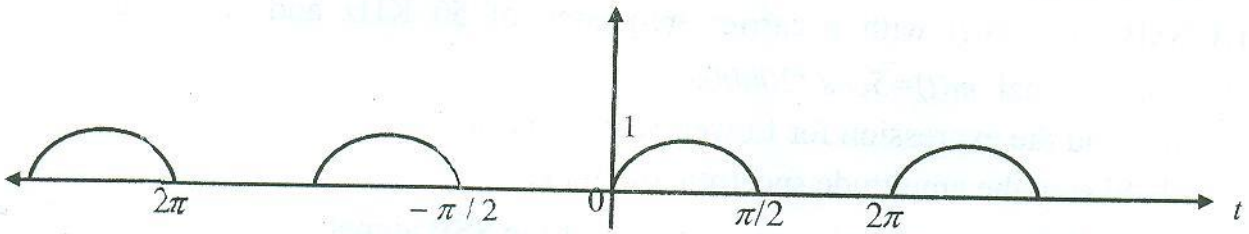


Figure (1)

(2) Find the complex exponential Fourier series and sketch the corresponding spectra of the periodic impulse train $\delta_{T_0}(t)$ shown in Figure (2).

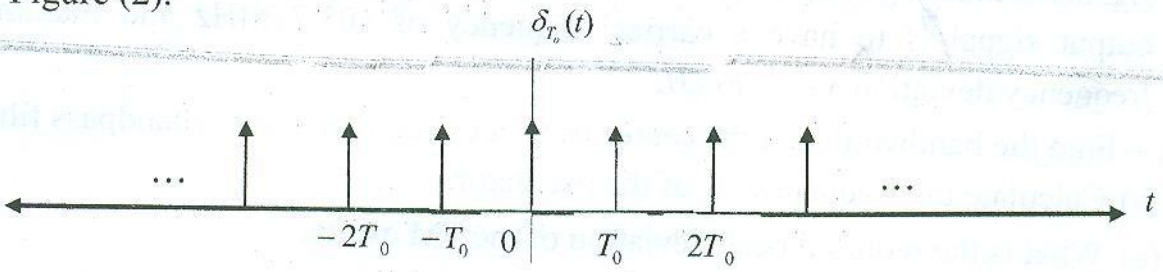


Figure (2)

(3) State the Parseval's theorem.

Question (2) (10 degrees)

(1) Determine the Fourier transform of the following functions:

$$(a)\quad s(t) = \begin{cases} e^{j2\pi t} & |t| < 1 \\ 0 & otherwise \end{cases}$$

$$(b)\quad g(t) = \cos(2t)U(t)$$

$$(c)\quad x(t) = te^{-at}U(t)$$

(2) Show that if $g(t) \Leftrightarrow G(f)$, then

(a) $g(t+T) + g(t-T) \Leftrightarrow 2G(f)\cos(2\pi fT)$

Question (3) (20 degrees)

(1) You are given the voltage signals $m(t)$ and $c(t) = A_c \cos(2\pi f_c t)$, Explain one method for generating the amplitude modulation with transmitted carrier (AM-TC) wave and one method for detection of this wave.

(2) An AM transmitter with a carrier frequency 850 kHz and the output power is 5000 watt, the sinusoidal tone of 1000 Hz is set for 90% modulation, and the transmitter output is feeding into a 50 Ω dummy load.

(a) Write an equation for the voltage that appears across the 50Ω load.

(b) Sketch the spectrum of this voltage.

(c) What is the average power that is being dissipated in the dummy load.

(3) A SSB signal $s(t)$ with a carrier frequency of 50 KHz and $A_c = 1$, the baseband signal $m(t)=5\cos(20000\pi t)$,

(a) Find the expression for Lower-SSB signal s(t) .

(b) Sketch the amplitude spectrum of $|S(f)|$.

(a) Find the normalized average power of the SSB signal

(b) Discuss one method for generating this SSB signal.

Question (4) (10 degrees)

(1) An FM transmitter has a block diagram as shown in Figure (3). The audio signals containing frequencies in the range of 20 Hz to 15 kHz band. The FM output signal is to have a carrier frequency of 103.7 MHz and maximum frequency deviation $\Delta f = 75\ kHz$

(a) Find the bandwidth and the center frequency required for the bandpass filter.

(b) Calculate the frequency f_0 of the oscillator.

(c) What is the required peak deviation of the FM exciter?

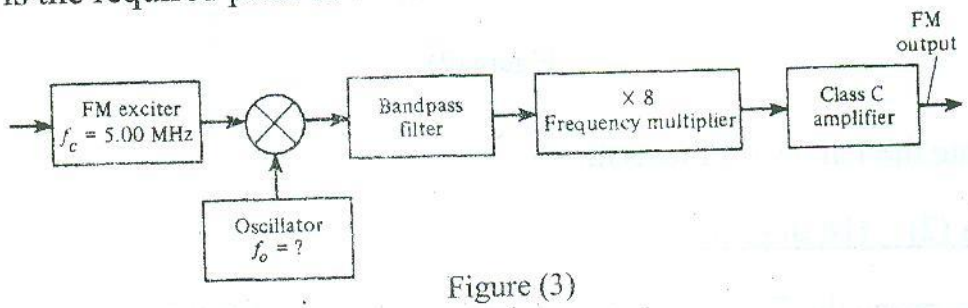


Figure (3)

(2) A single-tone FM signal is given by $s(t) = 10\sin[8\pi \times 10^6 t + 0.8\sin(2\pi \times 600t)]volts$. The modulating signal amplitude is 4V. Determine the modulation index, frequency deviation, the carrier power, and calculate the bandwidth of the FM signal using Carson's rule.

Good Luck

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