٢ - عنوان كورسيه

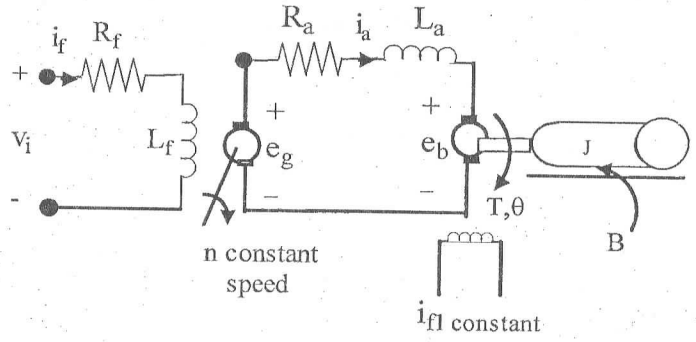
Tanta University | Department: Computers and Automatic Control | Faculty of Engineering

Total Marks: 85 Marks

Course Title: Automatic control Engineering	Year: 3rd
Date: Jun 2019	Allowed time: 3 hrs.

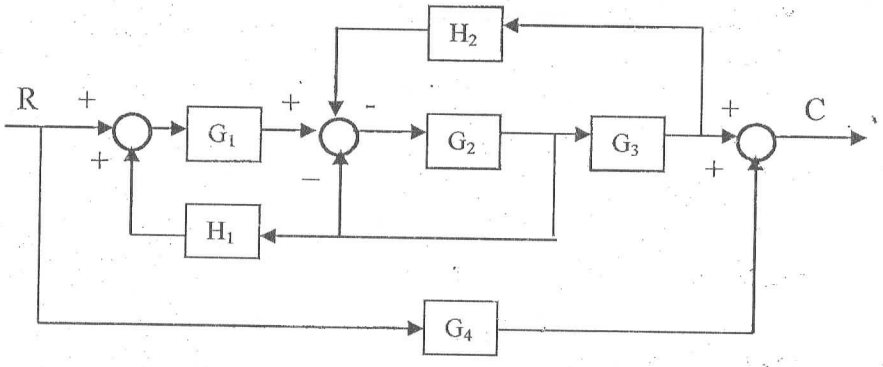
Remarks: answer the following questions

Q1: [a] A dc generator is connected with an armature controlled dc motor with the following specifications $e_g = k_g I_f$, $T = k_t I_a$, $e_b = k_b \theta$,



Find the overall transfer function $\theta(s)/V_i(s)$. (10 degree)

[b] Determine the transfer function using signal flow graph. (10 Marks)



Q2: [a] For each of the following characteristic equations, find the root distribution and determine whether the system is stable, marginally stable, cr unstable: (10 Marks)

i) $S^6+S^5 + 2S^4 + 2S^3 + 3S^2 + 2S + 4 = 0$

ii) $S^7 + 3S^6 + 3S^5+ S^4+ S^3+ 3S^2 + 3S + 1 = 0$

iii) $S^6 + 2S^5 + 8S^4 + 15S^3 + 20S^2 + 16S + 16 = 0$

[b] For the system has the transfer function $\frac{5}{s^2+s+6}$, assuming unity negative feedback

1) Compute the rise time and the percentage overshoot for the step input (5 Marks)
2) The error constants (4 Marks)
3) The steady state error for step input (2 Marks)

Q3: [a] Find a state space model for a control system having the transfer function:

$$G(s)=\frac{1}{s}\frac{4}{(s+2)}\frac{(s+5)}{(s^2+3s+7)}$$

in the pole-zero form (8 Marks) and other form (3 Marks)

[b]The open loop T.F. of a negative feedback system is given as: (12 Marks)

$$G(s)H(s)=\frac{k}{(s+1)(s+3)(s+5)}.$$

1) Sketch the root locus.
2) Determine the range of K for system stability.
3) Find the value of K at critically damped response.

Q4: [a] Given a system described by the dynamic equations

$$\frac{\mathbf{dx(t)}}{\mathbf{dt}}=\mathbf{Ax(t)+bu(t)} \qquad \mathbf{y(t)=cx(t)}$$

where

$$\mathbf{A}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -1 & -2\end{bmatrix} \qquad \mathbf{b}=\begin{bmatrix}0\\0\\1\end{bmatrix}, \text{ and } \quad \mathbf{c}=\begin{bmatrix}1 & 1 & 0\end{bmatrix}$$

i) The characterstic equation. (2 Marks)
ii) Find the transfer function Y/U. (3 Marks)

[b] i) For the following system draw the state diagram. (3 Marks)

$$\dot{\underline{X}}=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\underline{X}+\begin{bmatrix}2\\1\end{bmatrix}u$$

$$y=\begin{bmatrix}3 & 1\end{bmatrix}\underline{X}$$

ii) Determine whether the given system in (b-i) is stable , comple tely state controllable and observable or not. (5 Marks)

[c] 1- Explain three properties of the system and give an example for each.
2- Define the system order and the state of the system.
3- Define controllability and observability. (8 degree)

٣ قوى

Tanta University
Faculty of Engineering
Electrical Power and Machines Engineering Dept.

Final Exam – First Semester 2018-2019

Course: EPM3111(Electrical Machines 2)	**Time allowed:** 3 hours
Year: 3rd Electrical Power and Machines Eng.	**Date:** 9 Jan 2018
No. of Pages: 2	**Total Score:** 120

Attempt to solve the following questions.
Answers should be supported by sketches as you can

Question 1 — 30 Points [3×10]

A 50-kVA 20,000/480-V 60-Hz single-phase distribution transformer is tested with the following results:

	Open-circuit test (measured from secondary side)	Short-circuit test (measured from primary side)
Voltage	480 V	1130 V
Current	4.1 A	1.30 A
Power	620 W	550 W

REMARK: FROM Points (a)-(f) YOU SHOULD USE ALL PARAMETERS IN PER-UNIT SYSTEM, WHILE FROM (g)-(j) USE THEIR ACTUAL VALUES.

a) **Find the per-unit equivalent circuit for this transformer.**
b) **What is the efficiency of the transformer at rated conditions and unity power factor?**
c) **What is the per-unit loading of this transformer at maximum efficiency conditions? Then, determine the maximum efficiency?**
d) **What is the voltage regulation at rated conditions and unity power factor?**
e) **What is the load power factor for zero voltage regulation at rated conditions?**
f) **If the transformer has the following load-cycle: No-load for 6hr, 70% loading at 0.8 lag p.f. for 10hr, and 90% loading for 8hr at 0.9 leading p.f. Determine the ALL-DAY efficiency?**
g) **What would the ratings (kVA, and V) of this transformer be if it were operated on a 50-Hz?**
h) **Sketch the equivalent circuit of this transformer referred to the primary side (all parameters should be in ohms) if it is operating at 50 Hz.**
i) **What is the efficiency of the transformer at rated conditions on a 50 Hz power system, with UPF?**
j) **What is the voltage regulation at rated conditions on a 50 Hz power system, with UPF?**
k) **How does the efficiency of a transformer at rated conditions and 60 Hz compare to the same physical device running a 50 Hz?**

Question 2 — 15 Points [5+5+5]

a) **What is an autotransformer? List its advantages and drawbacks.**
b) **With the aid of necessary equations and figures, explain the principle of copper saving in an autotransformer.**
c) **A 10 kVA, 460/ 120 V, 60 Hz transformer has an efficiency of 96% when it delivers 9 kW at 0.9 power factor. This transformer is connected as an autotransformer to supply load to a 460 V circuit from a 580 V source.**
   (1) Show the autotransformer connection.
   (2) Determine the maximum kVA the autotransformer can supply to the 460 V circuit.
   (3) Determine the efficiency of the autotransformer for full load at 0.9 power factor.

Question 3	20 Points [4X5]

[A] State true (√) or false (×) and correct the false statements

(1) The transformer draws a no-load current when it's secondary is opened.

(2) The currents in the windings of an ideal transformer are inversely proportional to the turns of the windings.

(3) When a transformer is supplied by full-load at 0.8 power factor lagging its copper losses is given by Pcu. If it is supplied by half-load, then copper losses will be 2Pcu.

(4) In a three-phase transformer fed from a fundamental frequency of voltage source, the source of harmonics is the unbalanced loads.

(5) An autotransformer having a transformation ratio of 0.8 supplies a load of 3 kW. The power transferred conductively from primary to secondary is 1.5 kW.

[B] What happens to a transformer when it is first connected to a power line? Can anything be done to mitigate this problem?

[C] What are the conditions for satisfying parallel operation of single-phase transformers?

Question 4	35 Points [10+15+10]

a) Explain the two problems on Y-Y connected 3-phase transformers. Then, explain the two methods to solve these problems.

b) Describe the line/phase currents and line/phase voltages for a standard Δ-Δ connected transformer and for an open-delta transformer. How much power can an open-delta deliver compared to a standard three phase delta transformer? What happens to the rest of the open-delta bank's rating?

c) Explain, with equations and figures, the problem of current inrush. Why switching the primary of the transformer at 0 degree of input voltage is the worst case of inrush current and 90 degree is the no problem case. Show the answer with equations and waves. Then explain that: for part of the cycle, the transformer locks like short circuit and very large current flows.

Question 5	20 Points [10+10]

a) A three-phase transformer bank is to handle 500 kVA and have a 34.5/11-kV voltage ratio. 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 to (a) Y-Y, (b) Y-Δ, (c) Δ-Y, (d) Δ-Δ, (e) open-Δ, (f) Open-Y-open-Δ.

b) Determine the dimensions of the core, the number of turns, and the cross-sectional area of conductors in the primary and secondary windings of a 100 kVA, 2200/480 V, single-phase core-type transformer to operate at a frequency of 50 Hz, assuming the following data: approximate voltage per turn = 7.5 V, maximum flux density = 1.2 Wb/m2, ratio of effective cross-sectional area of core to square of diameter circumscribing circle = 0.6, ratio of height to width of window = 2, window space factor = 0.28, current density = 2.5 A/mm2.

Wish you all the best **A. Prof. Abdelsalam Ahmed** and **Dr. Sherif Dabour**

٣ فنون كهرباء

Tanta University | Department: Electrical Power and Machines Engineering | Faculty of Engineering

Total Marks: 70 Marks

Course Title: High Voltage Engineering	Course Code: EPM3112	Year: 3rd
Date: 12 Jan 2019 (First term)	Allowed time: 3 hrs	No. of pages: (2)

Answer all the following questions:

Question (1) (17 Marks)

a) For a certain gas, if the energy gained by an electron between two collisions in an electric field of 30 kV/cm is 4.8×10^{-20} J, find the collision cross-section given that the number of molecules per unit volume is 10^{18} and the electron charge is 1.6×10^{-19}. If the pressure is doubled, what is the value of collision cross-section and energy gained? (5 Marks)

b) Derive an expression for generation of electron avalanche according to Townsend. Then, derive an expression for current growth considering secondary ionization processes. What is the condition of breakdown in this case? (5 Marks)

c) If f_1 is the frequency at which all positive ions can just be cleared from the gap during on half-cycle and f_2 is the frequency at which all electrons can just be cleared from the gap during on half-cycle, describe with only sketches the change of breakdown voltage as a function of frequency. (4 Marks)

d) Complete the following sentences: (3 Marks)

1. ..... is the state of an atom when an electron move to higher energy level with a relatively long lifetime before returning to its normal energy level.
2. After the appearance of initial electron, the time required for the ionization processes to develop and cause breakdown of the gap is called .....
3. In long gaps under non-uniform field, the possible breakdown mechanism is .....

Question (2) (17 Marks)

a) The number of stages of a Cockcroft-Walton type voltage multiplier with 80 nf capacitances is 9 stages. If the voltage regulation at a load current of 8 mA is 8%, calculate the maximum secondary voltage of the supply transformer at a frequency of 100 Hz. Find also the percentage ripple and the optimum number of stages for minimum voltage drop. (5 Marks)

b) Draw the schematic diagram of the following: (5 Marks)

1. Van de Graff generator.
2. 3-stage Marx generator.

c) An impulse generator with each condenser rated for 0.12 μF and 130 kV. The load capacitor is 1200 pF and the series resistance is 1000 Ω. Find the number of stages and the damping resistance needed to produce a 3.396/60 μs impulse wave. (4 Marks)

d) Complete the following sentences: (3 Marks)

1. To reduce the size and cost of the insulation in cascaded transformers, ... is used.
2. The voltage efficiency of an impulse generator is given by .....
3. ..... is the process of eliminating the effect of stray capacitance in potential divider by surrounding the resistor with a conducting metal kept at the mean potential of the resistor.

Question (3) **(18 Marks)**

a) In an experiment for determining the breakdown strength of transformer oil, the breakdown voltage was 60 kV at gap spacing 4 mm and 120 kV at gap spacing 6 mm. Is this oil acceptable or not? Prove your answer. (5 Marks)

b) Plot the graphical representation of the following: (6 Marks)

1. Partial discharge sequence in a cavity into a solid dielectric under AC voltage.
2. Breakdown due to suspended particles in liquid dielectrics.
3. Rate of energy loss from electrons to lattice and energy gain by electrons in solid dielectrics at three different electric fields $E_1 > E_2 > E_3$.

c) A cylindrical gas filled void of diameter 0.2 mm and thickness 0.15 mm is contained within a slab of solid dielectric with a thickness of 2 cm. The breakdown strength of the gas within the void is 5 MV/m. To cause a breakdown across the void a voltage of 75 kV is required across the dielectric. When a breakdown occurs inside the void the voltage across void drops to 250 V. (7 Marks)

1. Calculate the voltage across the void when breakdown occurs.
2. Calculate the permittivity of the solid insulating material.
3. Calculate the number of partial discharge pulses per second for an applied voltage of 150 kV across the dielectric.

Question (4) **(18 Marks)**

a) Complete the following sentences: (5 Marks)

1. The following two methods are used for protecting substations against lightning stroke ..... and .....
2. The attenuation factor for resistive potential divider will be ..... without compensation and ..... with compensation.
3. The attenuation factor for capacitive potential divider will be .....

b) A high-voltage, 50 Hz AC signal of amplitude X with a superimposed DC component of Y was measured by a peak voltmeter and an electrostatic voltmeter. The reading of the peak voltmeter was 40 kV and the reading of the electrostatic voltmeter was 30 kV. If this signal was measured by a sphere gap at a temperature of 25 °C and pressure of 735 torr, what is the measured value that will be obtained from the table? Assume that the air density factor is equal to the correction factor. (6 Marks)

c) A single-phase lossless overhead line with $Z_A = 400\ \Omega$, $\upsilon_A = 3\times10^8$ m/s and $L_A = 30$ km is connected to a single phase lossless cable with $Z_B = 100\ \Omega$, $\upsilon_B = 2\times10^8$ m/s and $L_B = 20$ km. At the sending end of line A, there is a generator with neglected internal impedance. At the receiving end of cable B is an open circuit. Find the voltage V ($x = 10$ km, $t = 0.45$ ms). (7 Marks)

Best wishes:

Ass. Prof. Diaa-Eldin Mansour

كلية هوى كهربية
٢٠١٩/١/٢٣

Tanta University | Department: Power & Electrical Machines | Faculty of Engineering

Total Marks: (50) Marks

Course Title: (Elective Course 1) Electrical Communications	Course Code: EEC 3143	Year: 2018/2019
Date: 23/1/2019	Allowed time: (3) hrs.	No. of Pages: (2)

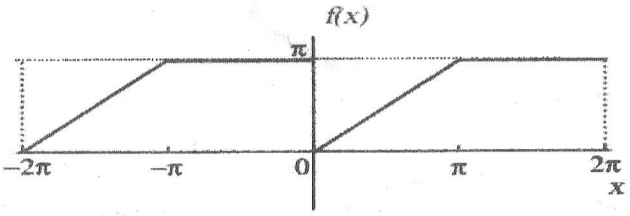
Question No. 1:

Complete the following sentences: **(15 Marks)**

1. Using the Fourier series, a periodic signal can be represented as the sum of.....
2. In phase modulation, the frequency of the carrier wave is varied.....with the baseband signal.
3. In amplitude modulation, the portion of the spectrum lying above the carrier frequency is referred to as .....
4. In frequency modulation (FM), ... represents the maximum departure of the instantaneous frequency of the carrier frequency.
5. ..... defines an approximate rule for the transmission bandwidth of FM wave generated by a single-tone modulating wave.
6. The narrow-band FM wave is effectively composed of a carrier and ..... of side-frequencies.
7. When .....% modulation is used in AM wave, the total power in the two side-frequencies of the resulting AM wave is only third of the total power.
8. The quantity $|C_n|^2$ in Parseval theorem, refers to as..... of the periodic signal.
9. Integration of a function $g(t)$ has the effect of dividing its Fourier transform $G(f)$ by a factor..... assuming that $G(0)$ is zero.
10. For a function $g(t)$, if the magnitude of the its Fourier transform $G(f)$ is unaffected, but its phase is changed then this is the ..... property.
11. In the indirect method of producing frequency modulation, the modulating wave is first .....
12. Fourier Transform for a truncated decaying exponential pulse is.....
13. The time shifting property states that if a function $g(t)$ is shifted in positive direction by an amount t_0, the effect is equivalent to multiplying its Fourier transform by the factor.....
14. Inverse Fourier transform of the function: $0.5[\text{sinc}(f-f_c) + \text{sinc}(f+f_c)]$ is.....
15. The simplest circuit for the demodulation of AM wave is.....

Question No.2: **(35 Mark)**

a. Find the Fourier series for the periodic extension of the following signal:



b. Determine the Fourier transform for the following functions:

1. $g(t) = rect\left(\frac{t-2}{4}\right) + 8\sin(6\pi t)$
2. $w(t) = te^{-at}u(t)$

c. How the balanced modulator can be used for the generation of DSBSC wave.

d. Compare between the frequency discriminator and phase discriminator circuits used for the generation of SSBSC wave then indicate which one is better.

e. Explain how a non-linear device can be used for both the generation and the demodulation of AM wave.

f. Prove that the narrow-band FM wave is somewhat similar to the corresponding one defining an AM wave.

g. Explain with drawing how to use voltage controlled oscillator (VCO) for the generation of *both* a phase modulated (PM) wave and a wide band frequency modulated wave.

The end of questions

Good luck
Dr. Roayat Ismail (Coordinator of the Course)

جامعة فوى كهربية

٢٠١٩/١/٢٦

Course Title: statistics analysis(70M)	(3d Elec. Power)	PME 3114
Date: Jan.2019	Time: 3 hour	No. of Pages: (2)

Q(1) (23 M)

(a) From the following distribution of data

Age	0 -5	5-10	10-15	15-20	20-25	25-30	30-35
frequency	4	8	12	20	11	9	5

Find:
- **(i)Mean by short cut method**
- **(ii)Standard deviation by shortest method**
- **(iii) Median for grouped data**
- **(iv)Mode for grouped data**

(b)The following table show 10 students according to achievements in both the laboratory and lectures of a course .

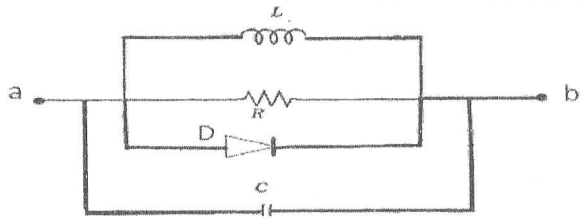
Laboratory(x)	8	3	9	2	7	10	4	6	1	5
Lecture (Y)	9	5	10	1	8	7	3	4	2	6
Lecture (z)	10	7	11	4	9	12	6	8	3	7

Find (i) r_{xy}, , r_{yz} (ii) Regression plane equation of X on Y and Z

(c) Prove $P(A \cup B \cup C)$=P(A)+P(B)+P(C)-P(A∩ B)- P(A ∩C)- P(B∩ C)+ P(A∩ B ∩C)

Q(2) (23M)

(a) In the following diagram, when we turned on Inductor L works with probability 0.8 , Capastor C works with probability 0.9 , Resistor works with probability 0.7 and Diade works with probability 0.6 . If it working properly current can flow through it when it is turned on



Let y be arandom variable represented the numbers of paths from a to b find (i) The cumulative distribution function

(ii) Expected number of paths,V(5y+6) and $M_{3y}(6t+4)$

(b) In certain assembly plant, three machines A, B, C make 50%, 20%and 30% respectively of the products.If 2%,6%,4% of products made by each machine, respectively are defective. If we select one item from finished product

(i)what the probability that it is defective and its numbers if total numbers 1000?

(ii)If the chosen item is defective what the probability that it is from A and its numbers ?

(iv)If we chose three items what the probability that the 3d is defective if the 1st is defective

(c) Consider $P(A-B)=0.3$, $P(B-A)=0.2$ and $P(A\cup B)=0.6$ find

(i) $P(A^c/B)$

(ii) $P(A^C/B^c)$

Q(3) (24M)

(a) Consider $f(x)=\begin{cases} kx+3 & -3\le x\le -2 \\ 3-kx & 2\le x\le 3 \\ 0 & \text{otherwise} \end{cases}$

(i)Find the value of k to make f(x) P.D.F and $p(-1\le x\le 1\ /\ 0\le x\le 5)$

(ii)Find accumulative distribution function F(x)

(ii)Find μ_r' and use it to find $E[(3x+5)^4]$ and V(4x+8)

(b) In a production of iron rods X is continuous random variable with normally distribution represent defectives in iron rods diameter with mean $\mu=2$ and standard deviation $\sigma=0.008$.

(i)what probability of defectives between tolerance limits 1.98 and 2.02

(ii) what probability of defectives in at least 2.66 limit

(c) Deduce the form of

(i)Expectation E(x)

(ii) Variance V(x)

(iii) Moment generating $M_x(t)$

For geometric Distribution by used its probability mass function

With my best wishes

Dr: M.Shokry

٣ قوى كهربية

٢٠١٩/١/١٦

Tanta University

Department: Elec. Power and Machines Engineering

Total Marks: 90 Marks

Faculty of Engineering

Title: Generation and economy of electrical energy	**Course Code: EPM3110**	**Year: Third year**
Date: January 16th 2019 (First term)	**Allowed time: 3 hrs**	**No. of Pages: (2)**

الإمتحان مكون من ٣ أسئلة فى صفحتين

Problem number (1) (30 Marks)

a) Choose the best answer and give reason(s) for your choice: **(5 points)**

i) Peak power plants have load factor in the range of:
(1) 0.1-0.6 (2) 0.3 – 0.8 (3) 0.5 – 0.9 (4) 0.7-1.0

ii) The straight-line method of depreciation is characterized by:
(1) simplicity and accuracy (2) simplicity and fixed annual amount of set aside
(3) accuracy and low interest amount (4) accuracy and fixed amount of set aside

iii) The tariff method for electrical energy that depends on the connected load with a fixed maximum number of hours per year is named:
(1) General rate form (2) Straight line meter rate
(3) Flat Demand Rate (4) Block-metre rate

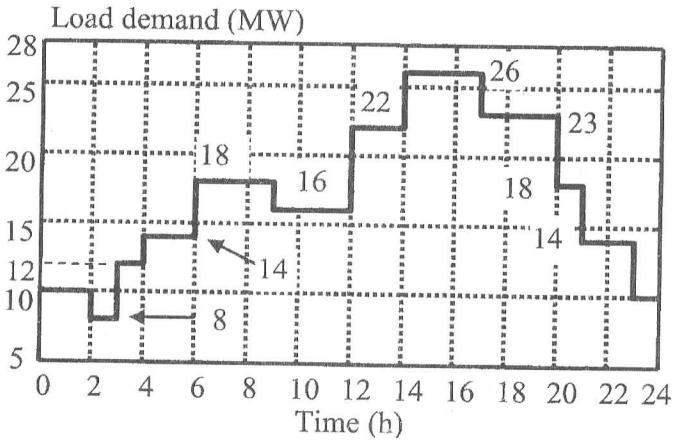
iv) The upper limit of phase angles is defined regarding:
(1) the transient stability of power systems (2) economic considerations
(3) thermal limitations (4) all the above

v) The ratio of input fuel to the corresponding output power is known as:
(1) Incremental fuel rate (2) fuel rate (3) heat value (4) Incremental heat rate

b) Decide whether the following statements are correct or false: **(5 points)**

i) The total annual cost of energy produced in power plants is the sum of four costs
ii) A main disadvantage of the diminishing-value method of depreciation is the high charges in the last year
iii) Hopkinson demand rate of two-part tariff is used for industrial customers
iv) The cost function is obtained from the input-output curve and is simplified in a linear form
v) The area under the duration load curve represents the consumed energy during this day and is equal to the maximum value in the energy curve

c) For the load curve shown, find the maximum and minimum loads, the average power, the consumed energy, the load factor and the demand factor assuming that the connected load is 100 MW. Draw the energy curve for this load curve. **(10 points)**



d) Discuss the classification and importance of operating constraints in power systems and explain the meaning of transformer tap settings constraint. **(10 points)**

P.T.O.

Problem number (2) (30 Marks)

a) A motor has an initial cost of 100000 L.E., a salvage value of 9000 L.E and an average life time of 15 year. After this time, the motor is actually sold as follows: 8000 for cupper and 6500 for iron. If the sinking-value method is used to calculate the depreciation, what is the actual total paid money at the end of the life time. Calculate the extra money that has to be paid to buy a new motor that costs 150000 L.E. Assume an annual rate of compound interest on the investment capital of 5%. **(10 points)**

b) The incremental fuel costs in \$/MWh for a plant consisting of 3 units are given by: $\frac{dF_1}{dP_1} = 0.08P_1 + 5.3$, $\frac{dF_2}{dP_2} = 0.012P_2 + 5.5$ and $\frac{dF_3}{dP_3} = 0.018P_3 + 5.8$. Assuming that all units are operating at all times and the total load demand is 975 MW, **find** the incremental fuel cost of the plant and the **optimal** allocation of load between the three units. The minimum and maximum capacities of unit 1 are, respectively, 200 and 450 MW. The minimum and maximum capacities of unit 2 are 150 and 350 MW. The minimum and maximum capacities of unit 3 are 100 and 225 MW. **(10 points)**

c) The fuel costs in \$/h for 3 plants are given by: $F_1 = 200 + 7P_1 + 0.008P_1^2$, $F_2 = 180 + 6.3P_2 + 0.009P_2^2$ and $F_3 = 140 + 6.8P_3 + 0.007P_3^2$. The minimum and maximum capacities on each unit are, respectively, 10 MW and 80 MW. Find the total fuel cost of the plant and the optimal allocation of load between the three units for a load of 150 MW. The power loss in transmission system is given as: $P_{loss} = 0.000218P_1^2 + 0.000228P_2^2 + 0.000179P_3^2$, where all quantities are specified in per unit on a base of 100 MVA. Start with a lambda value of 8.446, and penalty factors of unity and use tolerance of 0.002. **(10 points)**

Problem number (3) (30 Marks)

a) Describe the methods of improving thermal efficiency of gas-turbine power plants and the types of efficiencies in steam power plants. **(6 points)**

b) Mention the main components of hydraulic power plants and explain the main purpose of each component. **(6 points)**

c) What are the advantages and disadvantages of nuclear power plants and diesel power plants? **(6 points)**

d) Highlight the main operation principles of fuel cell and show why it has numerous applications. Illustrate the voltage-current characteristics of fuel cell units and explain the reasons of voltage drop in each section. **(6 points)**

e) A wind system has a swept area of 2500 m^2 and a power coefficient of 0.45. If the air density is 1.225 kg/m^3 and the efficiencies of generator and gear box are, respectively 95% and 90%, calculate the generated electrical power at a wind speed of 8 m/s. What is the angular speed if the mechanical power is 1011.2 Nm. **(6 points)**

Good Luck

Course Examination Committee

Prof. Ahmed Refaat Azmy Dr. Samir Dawoud