Tanta University

Faculty of Engineering

Department: Elec. Power and Machines Engineering

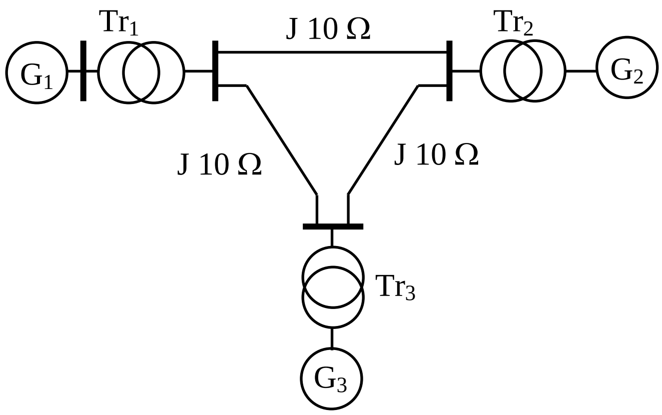
Total Marks: 120 Marks

Title: Electric power engineering (2)	**Course Code: EPM2207**	**Year: Second year**
Date: 19, June 2010	**Allowed time: 3 hr**	**No. of Pages: (2)**

Problem number (1) (40 Marks)

a) Starting from the equation: (V_s = A V_r + B I_r), deduce the receiving-end power circle diagram. Explain how you can use this diagram to illustrate the sending-end power circle diagram. (15)

b) For the network shown, the data of the system equipments are as follows:



Tr_1: 20 MVA, 11/110 kV, x=J0.12 p.u.

G_1: 20 MVA, 11 kV, x=J0.4 p.u.

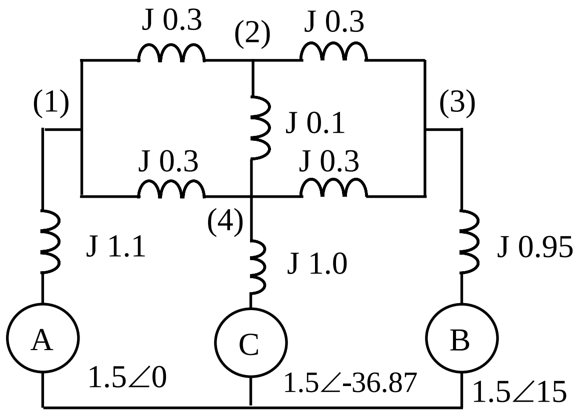
Tr_2: 10 MVA, 6/110 kV, x=J0.15 p.u.

G_2: 10 MVA, 6 kV, x=J0.35 p.u.

Tr_3: 5 MVA, 3/110 kV, x=J0.1 p.u. G_3: 5 MVA, 3 kV, x=J0.3 p.u.

Draw the impedance diagram for the network assuming bases of 20 MVA and 11 kV in the G_1 area. (15)

c) Derive the bus admittance matrix for the network shown. Calculate the node voltages for the four buses 1- 4. (10)



Problem number (2) (40 Marks)

a) Aided with phasor diagrams, discuss the methods of improving the voltage regulation in power systems (10)

b) Aided with phasor diagrams and equivalent circuits, compare in detail between series compensation and parallel compensation. (15)

P.T.O.

c) The optimal power factor for a certain factory with a kVA cost of 0.8 L.E./ kVA is 0.9. For the same capacitor cost, calculate the optimal power factor when the kVA cost is reduced to 0.75 L.E./ kVA. Comment on the results. (15)

Problem number (3) (40 Marks)

a) Discuss the advantages of the high-voltage DC transmission. Why this type of transmission is not widely used? (15)

b) Discuss in detail the different testes carried out on underground cables showing he location and timing of carrying out each test (15)

c) A single-core is used to supply a load at a voltage of 110 kV to earth. The used conductor has a radius of 0.5 cm and the cable has three different insulating materials permittivity of 6, 4 and 2 respectively. The maximum electric strengths in the three insulating materials are respectively: 70, 50 and 38 kV/cm (r.m.s). Find the minimum diameter of the cable. (10)

Good Luck

Course Examination Committee

Dr. Ahmed Refaat Azmy   Prof. Abdel Mohsen Kenawy

Dr. Mohamed Abdel Azez   Dr. Eman Saad

Course Coordinator: Dr. Ahmed Refaat Azmy

صفوى ١٦/٦

Tanta University		Mechanical Power Engineering Department Course Title: Mechanical power stations MEP2242		Faculty Of Engineering

Dept	Electrical power and Machines Engineering	Date	16/6/2010
Year	2^{rd}, (new curriculum) 2005	Allowed time	3 hrs
Final exam	June (second term)	Total Marks	50Marks
		Academic Number	2009/2010

يسمح للطالب باستخدام جداول وخرائط البخار

Question (1) **(8 marks)**

Two kg of air is compressed in a polytropic process with n = 1.3 and the volume of air is reduced 5 times. Determine the internal energy, the work spent , the amount of heat involved in the process, and the change in the enthalpy and entropy of the gas, assuming that initial temperature 17 C and initial pressure 2 bar

---

Question (2) **(8 marks)**

1- Air at 100 kPa and 280 K is compressed steadily to 600 kPa and 400 K. The mass flow rate of the air is 0.02 kg/s, and a heat loss of 16 kJ/kg occurs during the process. Assuming the changes in kinetic and potential energies are negligible, determine the necessary power input to the compressor.

Question (3) **(8 marks)**

Steam is the working fluid in an ideal Rankine cycle with superheat and reheat. Steam enters the first-stage turbine at 8.0 MPa, 480C, and expands to 0.7 MPa. It is then reheated to 440 C before entering the second-stage turbine, where it expands to the condenser pressure of 0.008 MPa. The net power output is 100 MW. Determine (a) the thermal efficiency of the cycle, (b) the mass flow rate of steam, in kg/h, (c) the rate of heat transfer from the condensing steam as it passes through the condenser, in MW. Discuss the effects of reheat on the vapor power cycle.

Question (4) **(10 marks)**

Consider a regenerative vapor power cycle with one open feed water heater. Steam enters the turbine at 8.0 MPa, 480C and expands to 0.7 MPa, where some of the steam is extracted and diverted to the open feedwater heater operating at 0.7 MPa. The remaining steam expands through the second-stage turbine to the condenser pressure of 0.008 MPa. Saturated liquid exits the open feedwater heater at 0.7 MPa. The isentropic efficiency of each turbine stage is 85% and each pump operates isentropically. If the net power output of the cycle is 100 MW, determine (a) the thermal efficiency and (b) the mass flow rate of steam entering the first turbine stage, in kg/h.

Question (5) (8 marks)

In a Brayton cycle with reheater and heat exchanger, the pressure ratio is 4:1. The pressure and temperature of the air entering the compressor are 1 bar and 27 C respectively. The air temperature at the inlet of both turbine stages is 827 C, If the HPT is coupled with air compressor, determine

a- The reheater pressure

b- The cycle thermal efficiency

Question (6) **(8 marks)**

In an experimental on the separating- throttling calorimeter the state of the separated moisture was 0.8 kg while that of condensate vapour was 1.3 kg. If the pressure of the wet vapour is 6 bar, and is reduced to 1 bar after the throttling valve where its temperature was then 120 C, find the dryness fraction of the wet steam.

Good luck

Course Examination Committee : Prof. Abdel Naby Kabeel
Course Coordinator : Prof. Aly M. Elzahby

د فوزي صبري ٦/١٤

Tanta University

Department of Physics & Mathematics

Faculty of Engineering

Course Title: Complex and Special Functions	Year: 2^{nd} Mech-power	Code: PM1201
Date: 2010 (2nd term)	Allowed time: 3 hrs	No. of Pages: (2)

Problem number (1) (10 M)

(a) Find all values of: (i) $\sqrt[3]{1+i}$ (ii) $\cosh\sqrt{z}=0$.

(b) Show that if $f(z)=u(x,y)+iv(x,y)$ **is analytic, then u(x,y) and v(x,y) are harmonics.**

(c) Determine c such that the function is harmonic $U=\sin x\cosh cy$ **and find its conjugate harmonic.**

Problem number (2) (16 M)

(a) Prove that If f (z) is analytic in a simply-connected region D, then for every simple closed curve C in D, $\oint_C \frac{f(z)dz}{(z-z_0)}=2\pi i f(z_0)$

(b) Evaluate $\oint_C \frac{z^3+1}{(z-1)(z-2)}dz$ around $C:|z|=3$.

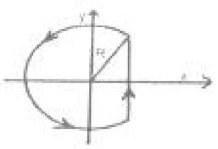
(c) Find Taylor expansion of $f(z)=\frac{z}{5-z}$ on the region $|Z|\le 5$ and using it to find

$\sum_{n=1}\frac{r^n}{5^n}\cos n\theta,\ \sum_{n=1}\frac{r^n}{5^n}\sin n\theta$

Problem number (3) (16 M)

(a) **Evaluate** (i) $\oint_{|z|=3}(z+1)e^{\frac{1}{z}}dz$ (ii) $\oint_{|z|=2} z^2\sin\frac{2}{z-1}dz$

(b) Using Bromwich contour



To find inverse Laplace transform of $F(s)=\frac{\cosh x\sqrt{s}}{s\cosh\sqrt{s}}$, $0<x<1$

c) Find the image of the region $2\le|z|\le 3,\ \frac{\pi}{6}\le \arg z\le\frac{\pi}{3}$ **by the map** $w=z+\frac{1}{z}$.

Problem number (4) (14 M)

a) Using series solutions to solve the following equations

(ii) $x^2y''+xy'+(x^2-\frac{4}{9})y=0$ near $x=0$

b) Evaluate the integrations using Gamma and Beta functions

(i) $\int_0^\infty x^3 \; e^{-2x} \cosh x \; dx$ (ii) $\int_0^{\frac{1}{2}} x^{m-1} \left(\ln \frac{1}{2x} \right) dx$

(iii) $\int_0^{\frac{\pi}{2}} \sqrt{\frac{\sin\theta}{\cos\theta}^{3}} \; d\theta$ (v) $\int_0^\infty \frac{1}{1+x^4} \; dx$

Problem number (5) (14 M)

(a) Use Generating function $e^{\frac{x}{2}(t-\frac{1}{t})} = \sum_{-\infty}^{\infty} J_n(x) t^n$ to prove that:

(i) $e^{ix\sin\theta} = J_0(x) + 2\sum_{n=1}^{\infty} J_{2n}(x)\cos 2n\theta + 2i\sum_{n=0}^{\infty} J_{2n+1}(x)\sin(2n+1)\theta$

(ii) $1 = J_0(x) + 2\sum_{n=1}^{\infty} J_{2n}(x)$ (iii) $x = 2\sum_{n=0}^{\infty}(2n+1) J_{2n+1}(x)$

(b) Prove that $J_{\frac{1}{2}} = \sqrt{\frac{2}{\Pi x}} \sin x$, $J_{-\frac{1}{2}} = \sqrt{\frac{2}{\Pi x}} \cos x$ and using these to express $J_{\frac{5}{2}}(x)$, $J_{-\frac{5}{2}}(x)$ in term of sinx and cosx.

(c) Evaluate $\int x^3 J_0 dx$

With my best wishes

ح قوى جديد

١٢

Tanta University	Faculty of Engineering
Electrical Power and Machines Department	2nd Electrical Year
Final 2nd Semester Exam.	Date: June 12, 2010
Course Title: DC Machines	No. of Pages: 2
Time Allowed: 3 Hrs.	Marks: 120

Answer the Following Questions [Make suitable assumptions if necessary]

[1] (1-a) A cumulatively compounded dc generator is operating properly as a flat-compounded dc generator. The machine is then shut down, and its shunt field connections are reversed. (6 Marks)

i. If this generator is turned in the same direction as before, will an output voltage be built up at its terminals? Why or why not?
ii. Will the voltage build up for rotation in the opposite direction? Why or why not?
iii. For the direction of rotation in which a voltage builds up, will the generator be cumulatively or differentially compounded?

(1-b) A separately excited dc generator gave the following data for open circuit characteristic at 1000 rpm.

I_f, A	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4
E_a, V	5	50	100	140	170	190	200	205

The armature resistance, including brushes is $0.5\,\Omega$. If the generator is now shunt connected and is driven at 1100 rpm, then, for a total shunt field resistance of $180\,\Omega$, **calculate;**

i. No-load emf;
ii. The output current and shunt field current for a terminal voltage of 190 V;
iii. The maximum output current and the corresponding terminal voltage;
iv. Steady state short circuit current;
v. In case no-load voltage of 210 V is required, find the additional resistance that must be inserted in the field circuit;
vi. For a shunt field resistance of $150\,\Omega$, the terminal voltage was found to be 180 V at a certain load at 1100 rpm. Find the load supplied by the generator and the generated emf. Assume that flux is reduced by 4 % due to armature reaction. (18 Marks)

[2] (2.a) (6 Marks)

i. List the different methods of speed control employed for dc shunt motor? Which one is the best and why?.
ii. Define the term " Speed Regulation" of a dc motor.

(2.b) A 5 kW, 250 V, dc shunt motor takes a no-load armature current of 4 A at rated voltage and runs at 1200 rpm. The armature circuit resistance is $0.4\,\Omega$ and the field resistance is $250\,\Omega$. At rated load and rated voltage, the motor takes 26 A and the armature reaction weakens the field flux by 2 %. Calculate the full-load speed and the corresponding electromagnetic torque of the motor. (18 Marks)

[3]	(3-a) (6 Marks) i. What is the function of a no-voltage release (NVR) coil provided in a DC motor starter? ii. Describe the working of a 3-point starter for DC shunt motor with neat diagram. --- (3-b) A 220-V, 1500 rpm dc motor has full-load armature current of 30 A. It is proposed to design a starter which restricts the maximum armature current during starting to 60 A. For design purposes, the minimum current during starting is to be restricted to 30 A. The series resistance in the armature circuit being cut in steps whenever the current falls to 30 A. Assuming that the armature resistance of the dc motor is 0.5 Ω. **Calculate** the maximum series resistance used in the starter and the amount of resistance cut during each of the first two steps. (18 Marks)
[4]	(4-a) (6 Marks) i. Explain the effect of armature reaction in a DC shunt generator. How are its demagnetizing and cross-magnetizing ampere turns calculated? ii. What are the functions of compensating winding and interpoles in DC machines? --- (4-b) A dc machine rated at 24 kW, 240 V, 1000 rpm and has $R_a = 0.12\,\Omega$, $N_f = 600$ turns/pole. The machine is operated as a separately excited dc generator and is driven at 1000 rpm. When $I_f = 1.8\,A$, the no-load terminal voltage is 240 V. When the generator delivers full-load current, the terminal voltage drops to 225 V. Determine; i. The generated voltage and developed torque when the generator delivers full-load. ii. The voltage drop due to armature reaction. iii. The full-load terminal voltage can be made the same as the no-load terminal voltage by increasing the field current to 2.2 A or by using series winding on each pole. Determine the number of turns per pole of the series winding required if I_f is kept at 1.8 A. (18 Marks)
[5]	(5.a) (6 Marks) i. What are equalizing connections? Why are these used only in lap-winding and not in wave-winding? ii. What is the relation between armature conductors, number of poles, the number of equalizing rings and connections per equalizing ring? iii. Mention guiding factors for the selection of number of poles. --- (5.b) A 40 kW, 230-V, 900 rpm, 4-pole dc shunt motor having the following data: Specific magnetic loading = 0.7 Wb/m^2, specific electric loading = 26000 ac/m, ratio of pole arc / pole pitch = 0.7, length of machine = pole arc, internal drop in armature circuit = 10 V, field current = 2.5 A, field mmf =125 % armature mmf, mmf required for air gap = 50 % armature mmf, gap contraction factor =1.15 , full-load efficiency = 89 %, the current density for brushes = 6 A/cm^2, and the current carried by each brush should not exceed 70 A. **Determine:** i. Main dimensions; ii. Number of armature conductors and type of winding; iii. Number of slots and no. of conductors per slot; iv. Armature mmf per pole; v. Field mmf per pole; vi. Length of air gap; vii. Length of commutator. (18 Marks)