Swami Keshvanand Institute of Technology,
Management & Gramothan

(Accredited by NAAC with ‘A++’ Grade)

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Affiliated to Rajasthan Technical University, Kota

Sample Assignment Sheets
Session: 2023-24

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Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Assignment-I

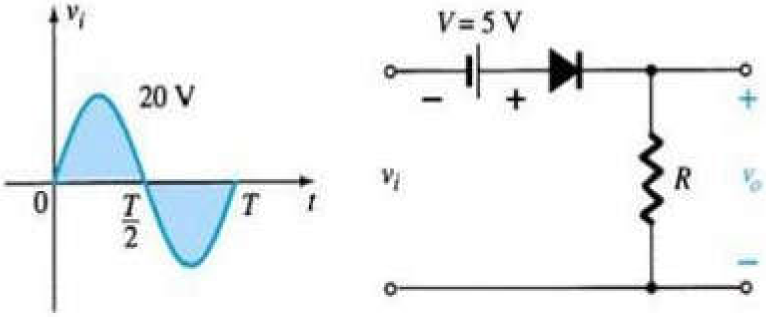
B.Tech. / Semester: II/III **Branch: ECE**
Subject: Electronic Devices **Subject Code: 3EC4-07**
Date of submission: 4/10/2023 **MM: 10**

Part A

1. Define mobility and conductivity of semiconductors.
2. What are Degenerate and non-degenerate semiconductors.
3. What is mass action law? Also write Einstein relation.
4. Why is silicon preferred over germanium in the manufacturing of semiconductor devices?
5. State continuity equation and write its expression.
6. What is Poisson's equation?
7. Define drift current and diffusion current.
8. Discuss the effect of temperature on conductivity of a semiconductor.
9. Differentiate between insulator, metal and semiconductor according to the energy band diagrams.
10. Differentiate between Direct and Indirect band gap semiconductors.

Part B

1. V_i is applied to the circuit with ideal diodes, as shown in the figure. Draw the output (V_o)waveform of the circuit.



2. Find the density of impurity atom that must be added to an intrinsic silicon crystal in order to convert it to
   a) P type silicon of resistivity 100 ohm-cm.
   b) N type silicon of resistivity 20 ohm-cm.

   Also calculate the concentration of minority carriers in each case. Given $\mu_e = 1350$ cm^2/V-sec, $\mu_h = 450$ cm^2/V-sec, $n_i = 1.5 \times 10^{10}\ cm^{-3}$

3. What is Hall effect? Describe with the suitable diagram.

4. Explain avalanche and zener breakdown?

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Assignment-I

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5. The electron concentration in a sample of uniformly doped n – type silicon at 300^{0}K varies linearly from $10^{17}/cm3\ at\ x = 0\ to\ 6 \times 10^{16}/\ cm3\ atx = 2\mu m$. Assume a situation that electrons are supplied to keep this concentration gradient constant with time. If electronic charge is 1.6 $\times 10^{-19}$ coulomb and the diffusion constant $D_n = 35\ cm^2$ $/S$. Find the current density in the silicon, if no electric field is present.

Part C

1. Discuss Thermistors and Sensistors with their applications
2. Define Generation and recombination rate of charge carriers in semiconductor and derive continuity equation.
3. Derive expression for total current density in semiconductors.
4. Find the resistivity of intrinsic silicon and when it is doped with a pentavalent impurity of one atom for each 60 million Si atoms. Given: No of Si atoms = 4.5*10^{28} m^{-3}, intrinsic concentration ni= 1.5*10^{16} m^{-3} . μe = 0.135 m^2/V-sec, μ_h = 0.048 m^2/V-sec,

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

B.Tech. / Semester: II/III **Branch: ECE**
Subject: Electronic Devices **Subject Code: 3EC4-07**
Date of submission: 25/11/2023 **MM: 10**

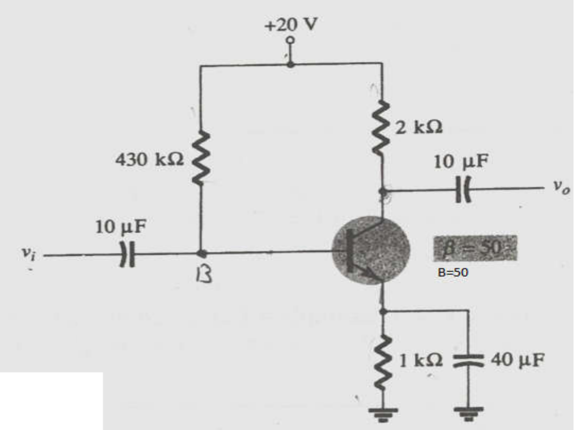
Assignment-II

Part A

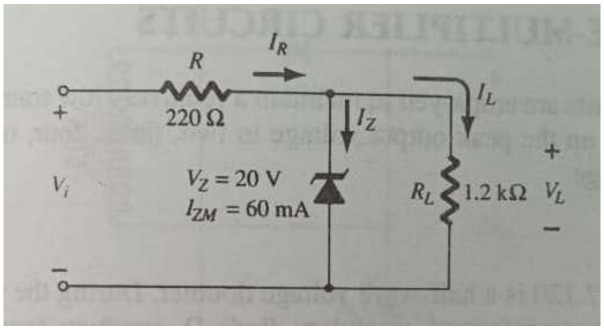
1. What is the working principle of photo diode?
2. Write the characteristic equation of a semiconductor diode and give the name of all the parameters used in equation.
3. What is thermal runaway and how can we avoid it?
4. Explain the need of biasing in BJT?
5. Distinguish between wet and dry etching.
6. How FET differs from BJT?
7. What is photolithography?
8. A diode current is 0.6 mA when applied voltage is 400mV and 20mA when applied voltage is 500mV. Find η. Assume V_T= 26mV.
9. Differentiate between enhancement & Depletion type MOSFET.
10. Draw the input and output characteristics of common base configuration of BJT.

Part B

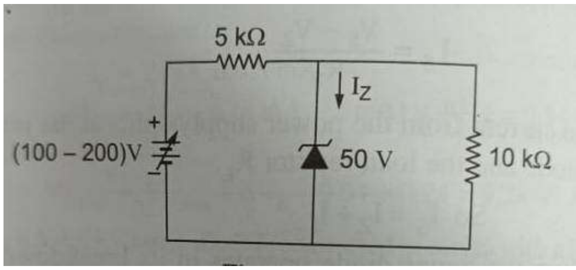
1. For the network given below If β=50, V_{BE}= 0.7V, Determine I_B, I_C, V_{CE}, V_C, V_E, V_B, V_{BC}



2. Determine the range of Vi that will maintain the Zener diode in "on" state.



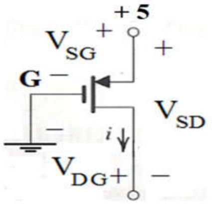
3. For the circuit shown in fig., determine the maximum and minimum current Iz



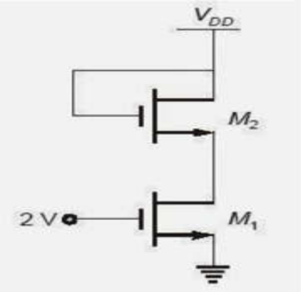
4. Explain Ebers-moll model with circuit diagram.
5. Draw the small signal model of MOSFET and explain its all components.

Part C

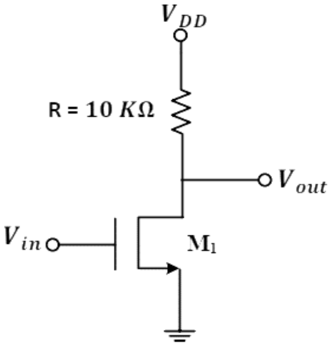
1. Explain Twin-tub process for CMOS fabrication with the help of diagrams in each step.
2. An enhancement PMOS transistor has $K_p = \mu_p C_{ox}\frac{W}{L} = 80\ \text{mA/V}^2$, V_{th} = -1.5V and λ= -0.2 V^{-1}. The gate is connected to ground and the source is connected to +5 V supply. Find the drain current for V_D = 4V, 1.5V, 0V and -5V.



3. In the circuit shown below, both the enhancement mode NMOS transistors have the following characteristics: $K_n = \mu_n C_{ox}\frac{W}{L} = 1\text{mA/V}^2,$ threshold voltage V_{TN} = 1volt. Assume that the channel length modulation parameter is zero and body is shorted to source. What is the minimum supply voltage V_{DD} (in volts) needed to ensure that transistor M1 operates in saturation mode of operation?



4. For the MOSFET M1 shown in figure, assume, W/L=2, VDD=2.0V, $\mu_n c_{ox}$=100 μm/V^2 and V_{TH}= 0.5V. For what value of V_{in}, The transistor M1 switches from saturation region to linear region.



Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-I)

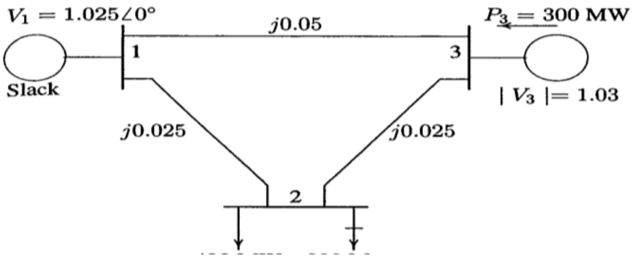
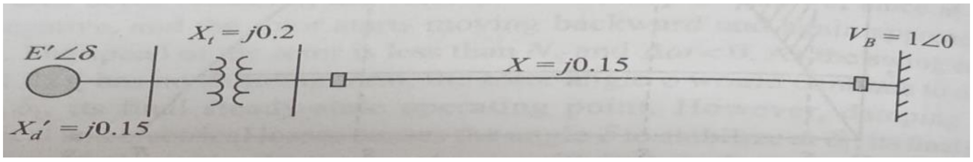
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power. (Reference: Power System Analysis by Hadi Saadat, TMH Pub.))


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P₂</th><th>Q₂</th><th>P₃</th></tr>
<tr><td>1.</td><td>300</td><td>100</td><td>200</td></tr>
<tr><td>2.</td><td>305</td><td>105</td><td>205</td></tr>
<tr><td>3.</td><td>310</td><td>110</td><td>210</td></tr>
<tr><td>4.</td><td>315</td><td>115</td><td>215</td></tr>
<tr><td>5.</td><td>320</td><td>120</td><td>220</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations. (Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>A 50-Hz, 100-MVA, 4-pole synchronous generator has an inertia constant of 3.5 sec and is supplying 0.16 pu power on a system base of 5000 MVA. The input to the generator is increased to 0.18 pu. Determine i) the kinetic energy stored in the moving parts of the generator and ii) the acceleration of the generator. If the acceleration continuous for 7.5 cycles, calculate iii) the change in rotor angle and iv) the speed in rpm at the end of acceleration.
(Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>Figure below shows a 3-phase synchronous generator connected through a line whose reactance is 0.15 pu to an infinite bus, whose voltage is 1.0 pu, and is delivering real power 0.8 pu at 0.8 power factor lagging to the bus. i) What is magnitude of the power input which can be suddenly increased without the generator losing synchronism? ii) If the input power is zero initially, calculate the sudden increase in input power without the generator losing synchronism. All values shown in the circuit diagram in per unit on a common system base.
(Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)

</td><td>3</td><td>2</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-II)

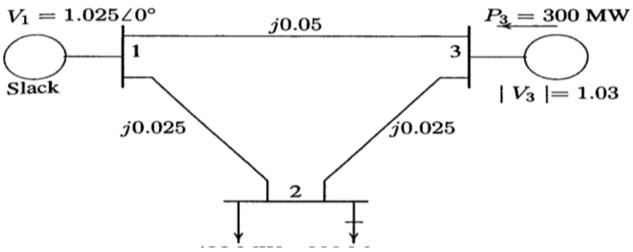
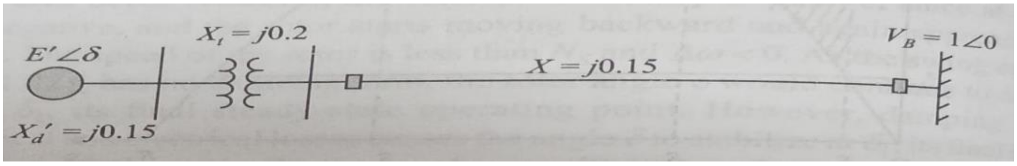
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power. (Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>6.</td><td>325</td><td>125</td><td>225</td></tr>
<tr><td>7.</td><td>330</td><td>130</td><td>230</td></tr>
<tr><td>8.</td><td>335</td><td>135</td><td>235</td></tr>
<tr><td>9.</td><td>340</td><td>140</td><td>240</td></tr>
<tr><td>10.</td><td>345</td><td>145</td><td>245</td></tr>
</table>
</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations. (Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>A 50-Hz synchronous generator is supplying 0.8 pu real power at 0.8 lagging power factor to an infinite bus via transmission line whose reactance is 0.4 pu. If the direct axis transient reactance of the generator is 0.2 pu and the inertia constant H = 10 MJ/MVA, determine i) the steady state power limit ii) synchronizing power coefficient iii) the frequency of free oscillations and iv) the time period of free oscillations. Assume the infinite bus voltage equal to 1.0 + <i>j</i> 0.0.
(Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>Figure below shows a 3-phase synchronous generator connected through a line whose reactance is 0.15 pu to an infinite bus, whose voltage is 1.0 pu, and is delivering real power 0.8 pu at 0.8 power factor lagging to the bus. A temporary 3-phase fault occurs at the sending end of the line which is cleared after five cycles and the line remains intact. Determine whether the generator will lose synchronism or not. i) If the generator remains stable calculate the maximum swing of the rotor ii) Compute the critical angle and critical clearing time of the fault.
(Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)


</td><td>3</td><td>2</td><td>10</td></tr>
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Faculty Name	Mr. Ajay Bhardwaj

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Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-III)

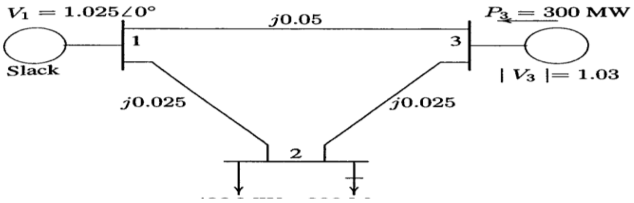
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + j 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


Table : Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>11.</td><td>350</td><td>150</td><td>250</td></tr>
<tr><td>12.</td><td>355</td><td>155</td><td>255</td></tr>
<tr><td>13.</td><td>360</td><td>160</td><td>260</td></tr>
<tr><td>14.</td><td>365</td><td>165</td><td>265</td></tr>
<tr><td>15.</td><td>370</td><td>170</td><td>270</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
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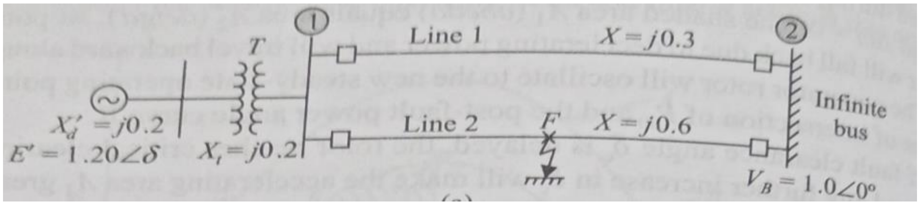
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>A synchronous generator is delivering 1.0 pu active power to an infinite bus of 1.0 pu voltage through a transmission line of 0.2 pu reactance and negligible resistance. The generator reactance is 0.3 pu and the voltage behind the reactance is 1.3 pu. A 3-phase short circuit fault occurs close to the generator terminals. Determine the torque angle before which the fault must be cleared by circuit breaker if the stability is to be maintained.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A 3-phase, 50-Hz synchronous generator is delivering 0.9 pu real power to an infinite bus via the transmission line shown in figure below. All values shown in the circuit diagram in per unit on a common system base. A temporary 3-phase fault occurs in the middle of line-2. Determine the rotor angle position before the fault occurs. Also compute the critical clearing angle if the fault is cleared by opening the faulted line. Assume H = 4.5 MJ/MVA.
(Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)

 </td><td>3</td><td>2</td><td>10</td></tr>
</table>

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Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-IV)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.
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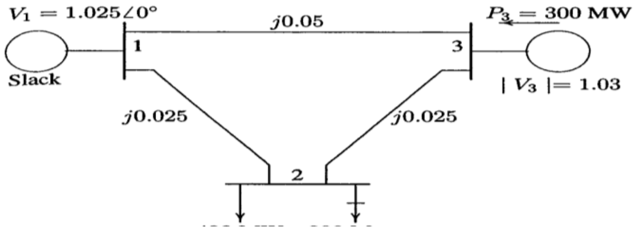
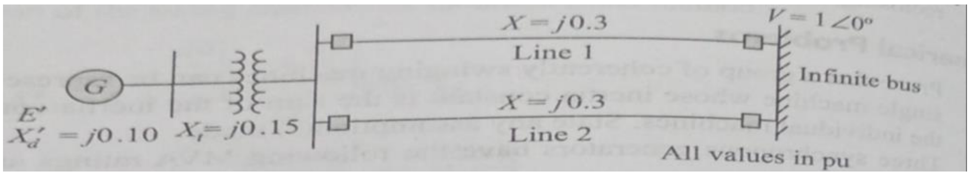


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>16.</td><td>375</td><td>175</td><td>275</td></tr>
<tr><td>17.</td><td>380</td><td>180</td><td>280</td></tr>
<tr><td>18.</td><td>385</td><td>185</td><td>285</td></tr>
<tr><td>19.</td><td>390</td><td>190</td><td>290</td></tr>
<tr><td>20.</td><td>395</td><td>195</td><td>295</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>A synchronous generator is delivering 0.5 of maximum power to an infinite bus through a transmission line. A fault occurs such that the new maximum power is 0.3 of the original. When the fault is cleared, the maximum power that can be delivered is 0.8 of the original maximum value. Determine the critical clearing angle. If the fault is cleared at $\delta = 75^o$. Find the maximum value of δ for which machine swings around its new equilibrium position.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A synchronous generator is supplying power to an infinite bus via two parallel lines as shown in figure below. All values shown in the circuit diagram in per unit on a common system base. If the power frequency 50-Hz and the inertia constant of generator is 4 MJ/MVA, calculate the voltage behind transient reactance and write the swing equation. Assume that the machine is delivering a power of 0.8 at a power factor of 0.85 lagging. A 3-phase fault occurs at the generator end through a reactance of 0.05 pu. Determine the accelerating power and acceleration at the time of fault. (Reference: Power System Analysis by Nagsarkar & Sukhija, Oxford Pub.)
 </td><td>3</td><td>2</td><td>10</td></tr>
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Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-V)

<table>
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<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + j 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.

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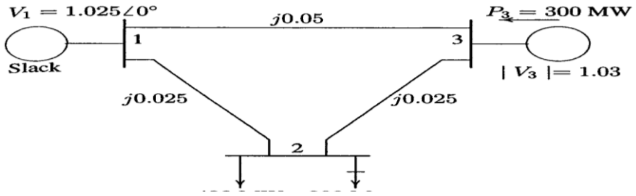
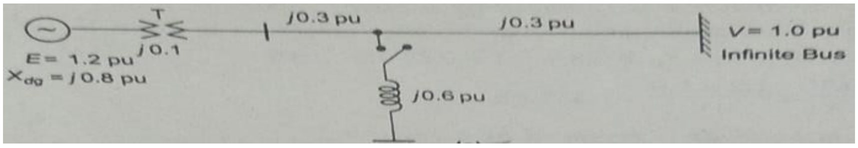


Table: Different Data for Experiment

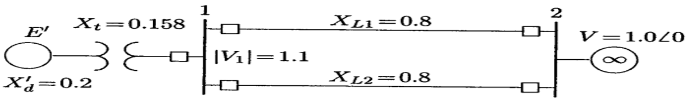
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>21.</td><td>400</td><td>200</td><td>300</td></tr>
<tr><td>22.</td><td>405</td><td>205</td><td>305</td></tr>
<tr><td>23.</td><td>410</td><td>210</td><td>310</td></tr>
<tr><td>24.</td><td>415</td><td>215</td><td>315</td></tr>
<tr><td>25.</td><td>420</td><td>220</td><td>320</td></tr>
</table>
</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations.

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>For the power system shown in Fig below, an inductor of reactance 0.6 pu per phase is connected at the mid-pint of transmission line. Determine the steady state power limit when switch is opened and closed.

(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)


</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A 60-Ha synchronous generator has a transient reactance of 0.2 pu and inertia constant of 5.66 MJ/MVA. The generator is connected to an infinite bus through a transformer and a double circuit transmission line as shown in Fig. Resistances are neglected and reactances are expressed on a common MVA base and are marked on the diagram. The generator is delivering a real power of 0.77 pu to bus-bar 1. Voltage magnitude at bus-1 is 1.1 pu. The infinite bus voltage is 1.0 pu. Determine the generator excitation voltage and obtain the swing equation. Also find the maximum power input that can be added without loss of synchronism.

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


</td><td>3</td><td>2</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-VI)

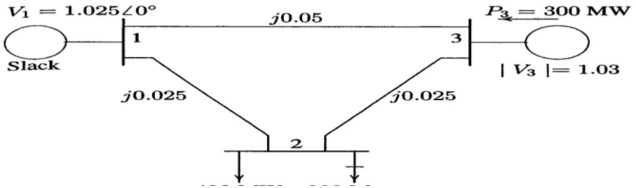
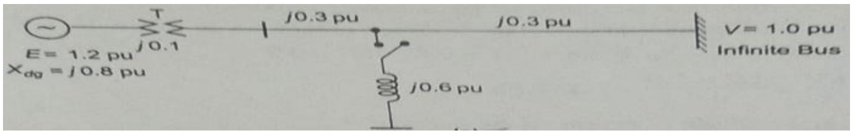
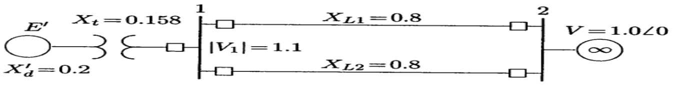
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>26.</td><td>425</td><td>225</td><td>325</td></tr>
<tr><td>27.</td><td>430</td><td>230</td><td>330</td></tr>
<tr><td>28.</td><td>435</td><td>235</td><td>335</td></tr>
<tr><td>29.</td><td>440</td><td>240</td><td>340</td></tr>
<tr><td>30.</td><td>445</td><td>245</td><td>345</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>For the power system shown in Fig below, a capacitor of reactance 0.6 pu per phase is connected at the mid-pint of transmission line in place of inductive reactance. Determine the steady state power limit when switch is opened and closed.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)

 </td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A 60-Ha synchronous generator has a transient reactance of 0.2 pu and inertia constant of 5.66 MJ/MVA. The generator is connected to an infinite bus through a transformer and a double circuit transmission line as shown in Fig below. Resistances are neglected and reactances are expressed on a common MVA base and are marked on the diagram. The generator is delivering a real power of 0.77 pu to bus-bar 1. Voltage magnitude at bus-1 is 1.1 pu. The infinite bus voltage is 1.0 pu. Determine the generator excitation voltage and obtain the swing equation. A temporary 3-phase fault occurs at the sending end of one of the transmission lines. When the fault is cleared, both lines are intact. Using equal area criterion, determine the critical clearing angle and critical fault clearing time.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

 </td><td>3</td><td>2</td><td>10</td></tr>
</table>

(Set-VII)

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

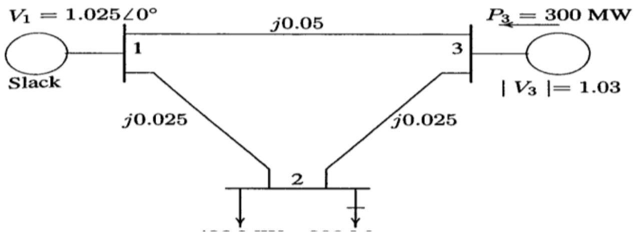
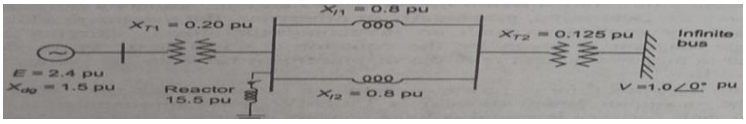
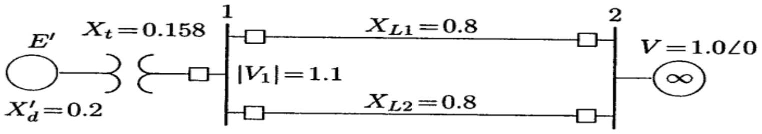
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P₂</th><th>Q₂</th><th>P₃</th></tr>
<tr><td>31.</td><td>450</td><td>250</td><td>350</td></tr>
<tr><td>32.</td><td>455</td><td>255</td><td>355</td></tr>
<tr><td>33.</td><td>460</td><td>260</td><td>360</td></tr>
<tr><td>34.</td><td>465</td><td>265</td><td>365</td></tr>
<tr><td>35.</td><td>470</td><td>270</td><td>370</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>For the power system shown in Fig. below, determine the maximum steady state power transfer when a shunt inductive reactor is connected and disconnected.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)

</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A 60-Ha synchronous generator has a transient reactance of 0.2 pu and inertia constant of 5.66 MJ/MVA. The generator is connected to an infinite bus through a transformer and a double circuit transmission line as shown in Fig. Resistances are neglected and reactances are expressed on a common MVA base and are marked on the diagram. The generator is delivering a real power of 0.77 pu to bus-bar 1. Voltage magnitude at bus-1 is 1.1 pu. The infinite bus voltage is 1.0 pu. Determine the generator excitation voltage and obtain the swing equation. A 3-phase fault occurs at the middle of one of the lines, the fault is cleared and the faulted line is isolated. Determine the critical clearing angle.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td><td>3</td><td>2</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-I Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-VIII)

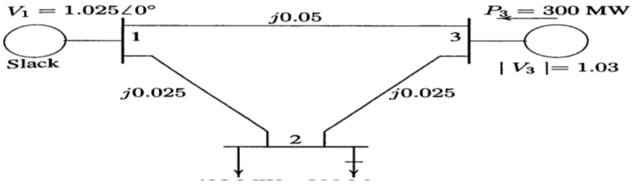
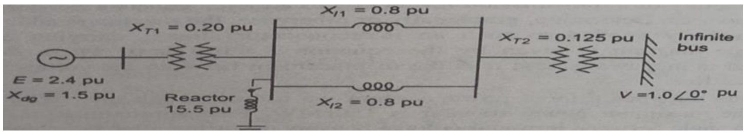
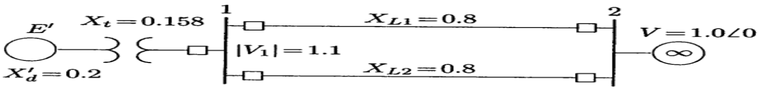
<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>The single-line diagram of a simple three-bus power system with generation at buses 1 and 3 is as shown in Fig. below. The voltage at bus-1 is (1.025 + <i>j</i> 0.0) per unit. The voltage magnitude at bus-3 is fixed at 1.03 per unit with a real power generation as shown in Table. The scheduled loads on bus-2 are shown in Table. Line impedances are marked in per unit. The line resistances and line charging suscepetances are neglected. Compute bus-voltages using the Gauss-Seidel method for two iterations. Also determine the line flows and line losses and the slack bus real and reactive power.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)


Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>P_2</th><th>Q_2</th><th>P_3</th></tr>
<tr><td>36.</td><td>475</td><td>275</td><td>375</td></tr>
<tr><td>37.</td><td>480</td><td>280</td><td>380</td></tr>
<tr><td>38.</td><td>485</td><td>285</td><td>385</td></tr>
<tr><td>39.</td><td>490</td><td>290</td><td>390</td></tr>
<tr><td>40.</td><td>495</td><td>295</td><td>395</td></tr>
<tr><td>41.</td><td>500</td><td>300</td><td>400</td></tr>
</table></td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>2.</td><td>Solve the same problem-1 using the Newton-Raphson method with tolerance 0.001 pu for two iterations.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>1</td><td>10</td></tr>
<tr><td>3.</td><td>For the power system shown in Fig. below, determine the maximum steady state power transfer when a shunt capacitive reactor is connected and disconnected in place of shunt inductor. (Reference: Electrical Power System by AShfaq Husain, CBS Pub.)

</td><td>3</td><td>2</td><td>10</td></tr>
<tr><td>4.</td><td>A 60-Ha synchronous generator has a transient reactance of 0.2 pu and inertia constant of 5.66 MJ/MVA. The generator is connected to an infinite bus through a transformer and a double circuit transmission line as shown in Fig. Resistances are neglected and reactances are expressed on a common MVA base and are marked on the diagram. The generator is delivering a real power of 0.77 pu to bus-bar 1. Voltage magnitude at bus-1 is 1.1 pu. The infinite bus voltage is 1.0 pu. Determine the generator excitation voltage and obtain the swing equation. The machine has per unit damping coefficient D = 0.15. Write the linearized swing equation for this power system and find the equations describing the motion of the rotor angle and the generator frequency for a small disturbance of $\Delta\delta = 15^0$.
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td><td>3</td><td>2</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-I)

Q.	Question	BL	CO	MM
1.	A three-phase transmission line has a resistance 10 ohm per phase and a reactance of 30 ohm per phase. (a) Determine the maximum power which may be transmitted if 132 KV were maintained at each end. (b) What is the phase difference between the receiving end and sending end voltages for maximum power transmitted? (c) Also, determine the rating of synchronous phase modifier to supply following load the receiving end. **Table: Different Data for Experiment** **S. No.** – **load** **1.** – 100 MW, 0.9 p.f. lagging **2.** – 90 MW, 0.85 p.f. lagging **3.** – 110 MW, 0.80 p.f. lagging **4.** – 800 MW, 0.75 p.f. lagging **5.** – 120 MW, 0.70 p.f. lagging **(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)**	4	3	10
2.	A single area consists of two generating units the flowing characteristics: Unit-1, 600 MVA, 6% speed regulation Unit-2, 500 MVA, 4% speed regulation The units are operating in parallel, sharing 900 MW at the nominal frequency. Unit-1 supplies 500 MW and unit-2 supplies 400 MW at 60 Hz. The load is increased as tabulated below: a) Assume there is no frequency dependent load (D=0). Find the steady-state frequency deviation and new generation on each unit. b) Assume there is frequency dependent load (D=tabulated below). Find the steady-state frequency deviation and new generation on each unit. **Table: Different Data for Experiment** **S. No.** – **Increased load** – **D** **1.** – 60 MW – 1.1 **2.** – 70 MW – 1.2 **3.** – 80 MW – 1.3 **4.** – 90 MW – 1.4 **5.** – 100 MW – 1.5 **(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)**	4	3	10
3.	Explain preventive and emergency control in power system with suitable example. **(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)**	3	4	10
4.	Draw and explain energy control centre of India in detail. **(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)**	3	4	10

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

<table>
<tr>
<td>5.</td>
<td>
For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:

$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$

Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:

$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>1.</td><td>800</td></tr>
<tr><td>2.</td><td>805</td></tr>
<tr><td>3.</td><td>810</td></tr>
<tr><td>4.</td><td>815</td></tr>
<tr><td>5.</td><td>820</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>
The fuel cost in $/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>1.</td><td>62</td></tr>
<tr><td>2.</td><td>82</td></tr>
<tr><td>3.</td><td>112</td></tr>
<tr><td>4.</td><td>132</td></tr>
<tr><td>5.</td><td>152</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
</table>

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Faculty Name	Mr. Ajay Bhardwaj

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Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-II)

Q.	Question	BL	CO	MM
1.	A three-phase transmission line has a resistance 25 ohm per phase and a reactance of 90 ohm per phase. The sending end voltage is 145 KV, while the load end voltage is maintained at 132 KV for all loads by an automatically controlled synchronous phase modifier. If the MVAR of the modifier has the same value for zero load as for a load mentioned in table. Find the rating of phase moodier and the power factor of this load. **Table: Different Data for Experiment** **S. No.** – **load** **6.** – 50 MW **7.** – 60 MW **8.** – 70 MW **9.** – 80 MW **10.** – 90 MW **(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)**	4	3	10
2.	A single area consists of two generating units the flowing characteristics: Unit-1, 400 MVA, 4% speed regulation Unit-2, 800 MVA, 5% speed regulation The units are operating in parallel, sharing 700 MW at the nominal frequency. Unit-1 supplies 200 MW and unit-2 supplies 500 MW at 60 Hz. The load is increased as tabulated below: c) Assume there is no frequency dependent load (D=0). Find the steady-state frequency deviation and new generation on each unit. d) Assume there is frequency dependent load (D=tabulated below). Find the steady-state frequency deviation and new generation on each unit. **Table: Different Data for Experiment** **S. No.** – **Increased load** – **D** **6.** – 90 MW – 0.80 **7.** – 100 MW – 0.90 **8.** – 110 MW – 1.00 **9.** – 120 MW – 1.10 **10.** – 130 MW – 1.20 **(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)**	4	3	10
3.	Explain preventive and emergency control in power system with suitable example. **(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)**	3	4	10
4.	Draw and explain energy control centre of India in detail. **(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)**	3	4	10

Table for Q1:

S. No.	load
6.	50 MW
7.	60 MW
8.	70 MW
9.	80 MW
10.	90 MW

Table for Q2:

S. No.	Increased load	D
6.	90 MW	0.80
7.	100 MW	0.90
8.	110 MW	1.00
9.	120 MW	1.10
10.	130 MW	1.20

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

<table>
<tr>
<td>5.</td>
<td>For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:
$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$
Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:
$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>6.</td><td>825</td></tr>
<tr><td>7.</td><td>830</td></tr>
<tr><td>8.</td><td>835</td></tr>
<tr><td>9.</td><td>840</td></tr>
<tr><td>10.</td><td>845</td></tr>
</table>
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>The fuel cost in $/hr. of three power plants are given by:
$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$
Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):
$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$
For this problem, assume the real power loss is given by the simplified expression:
$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$
Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>6.</td><td>50</td></tr>
<tr><td>7.</td><td>55</td></tr>
<tr><td>8.</td><td>60</td></tr>
<tr><td>9.</td><td>65</td></tr>
<tr><td>10.</td><td>70</td></tr>
</table>
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
</table>

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Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
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Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-III)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>
A 320 km, 275 KV three-phase line has the following general parameters:

$$\overrightarrow{A} = 0.94,\angle 1.0, \qquad \overrightarrow{B} = 107,\angle 78$$

If the receiving end voltage is 275 KV, determine (a) the sending voltage necessary if a load mentioned in table below is being delivered at the receiving end.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>11.</td><td>260 MW</td></tr>
<tr><td>12.</td><td>270 MW</td></tr>
<tr><td>13.</td><td>280 MW</td></tr>
<tr><td>14.</td><td>200 MW</td></tr>
<tr><td>15.</td><td>300 MW</td></tr>
</table>

(b) the maximum power that can be transmitted if the sending end voltage is held at 290 KV, (c) the additional reactive MVA that will have to be provided at the receiving end when delivering tabulated load below, the supply voltage being 290 KV.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>11.</td><td>410 MVA, 0.75 p. f. lagging</td></tr>
<tr><td>12.</td><td>420 MVA, 0.80p. f. lagging</td></tr>
<tr><td>13.</td><td>430 MVA, 0.85 p. f. lagging</td></tr>
<tr><td>14.</td><td>440 MVA, 0.90 p. f. lagging</td></tr>
<tr><td>15.</td><td>450 MVA, 0.95 p. f. lagging</td></tr>
</table>

(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)
</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>2.</td><td>
A single area consists of two generating units the flowing characteristics:
Unit-1, 400 MVA, 6% speed regulation
Unit-2, 300 MVA, 4% speed regulation

The units are operating in parallel, sharing 500 MW at the nominal frequency. Unit-1 supplies 300 MW and unit-2 supplies 200 MW at 60 Hz. The load is increased as tabulated below:

e) Assume there is no frequency dependent load (D=0). Find the steady-state frequency deviation and new generation on each unit.
f) Assume there is frequency dependent load (D=tabulated below). Find the steady-state frequency deviation and new generation on each unit.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Increased load</th><th>D</th></tr>
<tr><td>11.</td><td>60 MW</td><td>1.1</td></tr>
<tr><td>12.</td><td>70 MW</td><td>1.2</td></tr>
<tr><td>13.</td><td>80 MW</td><td>1.3</td></tr>
<tr><td>14.</td><td>90 MW</td><td>1.4</td></tr>
<tr><td>15.</td><td>100 MW</td><td>1.5</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>3.</td><td>Explain preventive and emergency control in power system with suitable example.
(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>4.</td><td>Draw and explain energy control centre of India in detail.
(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)</td><td>3</td><td>4</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

<table>
<tr><td>5.</td><td>
For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:

$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$

Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:

$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>11.</td><td>850</td></tr>
<tr><td>12.</td><td>855</td></tr>
<tr><td>13.</td><td>860</td></tr>
<tr><td>14.</td><td>865</td></tr>
<tr><td>15.</td><td>870</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td><td>4</td><td>5</td><td>10</td></tr>
<tr><td>6.</td><td>
The fuel cost in $/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>11.</td><td>75</td></tr>
<tr><td>12.</td><td>80</td></tr>
<tr><td>13.</td><td>85</td></tr>
<tr><td>14.</td><td>90</td></tr>
<tr><td>15.</td><td>95</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td><td>4</td><td>5</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-IV)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>A three-phase 50 Hz transmission line has a resistance 14 ohm per phase and a reactance of 48 ohm per phase. The capacitive sucepetance to neural is 4×10^{-4} Siemen. Find the MVAR rating at no-load and full-load of a synchronous phase modifier to maintain the sending end and receiving end voltages constant at 70 KV and 66 KV respectively when the line is delivering a tabulated load below.
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>16.</td><td>15 MVA, 0.9 p.f. lagging</td></tr>
<tr><td>17.</td><td>20 MVA, 0.85 p.f. lagging</td></tr>
<tr><td>18.</td><td>25 MVA, 0.80 p.f. lagging</td></tr>
<tr><td>19.</td><td>30 MVA, 0.75 p.f. lagging</td></tr>
<tr><td>20.</td><td>30 MVA, 0.70 p.f. lagging</td></tr>
</table>
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>2.</td><td>A single area consists of two generating units the flowing characteristics:
Unit-1, 500 MVA, 4% speed regulation
Unit-2, 700 MVA, 5% speed regulation
The units are operating in parallel, sharing 800 MW at the nominal frequency. Unit-1 supplies 300 MW and unit-2 supplies 500 MW at 60 Hz. The load is increased as tabulated below:
g) Assume there is no frequency dependent load (D=0). Find the steady-state frequency deviation and new generation on each unit.
h) Assume there is frequency dependent load (D=tabulated below). Find the steady-state frequency deviation and new generation on each unit.
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>Increased load</th><th>D</th></tr>
<tr><td>16.</td><td>90 MW</td><td>0.80</td></tr>
<tr><td>17.</td><td>100 MW</td><td>0.90</td></tr>
<tr><td>18.</td><td>110 MW</td><td>1.00</td></tr>
<tr><td>19.</td><td>120 MW</td><td>1.10</td></tr>
<tr><td>20.</td><td>130 MW</td><td>1.20</td></tr>
</table>
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>3.</td><td>Explain preventive and emergency control in power system with suitable example.
(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>4.</td><td>Draw and explain energy control centre of India in detail.
(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>5.</td><td>For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:
$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$
Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:
$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$</td><td>4</td><td>5</td><td>10</td></tr>
</table>

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<table>
<tr>
<td></td>
<td>

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>16.</td><td>875</td></tr>
<tr><td>17.</td><td>880</td></tr>
<tr><td>18.</td><td>885</td></tr>
<tr><td>19.</td><td>890</td></tr>
<tr><td>20.</td><td>895</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>

The fuel cost in $/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$

$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$

$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$

$$10 \le P_2 \le 80$$

$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>16.</td><td>100</td></tr>
<tr><td>17.</td><td>105</td></tr>
<tr><td>18.</td><td>110</td></tr>
<tr><td>19.</td><td>115</td></tr>
<tr><td>20.</td><td>120</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
</table>

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Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-V)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>A three-phase transmission line has a resistance 12 ohm per phase and a reactance of 40 ohm per phase. (a) Determine the maximum power which may be transmitted if 132 KV were maintained at each end. (b) What is the phase difference between the receiving end and sending end voltages for maximum power transmitted? (c) Also, determine the rating of synchronous phase modifier to supply following load the receiving end.
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>21.</td><td>100 MW, 0.90 p.f. lagging</td></tr>
<tr><td>22.</td><td>1100 MW, 0.85 p.f. lagging</td></tr>
<tr><td>23.</td><td>120 MW, 0.80 p.f. lagging</td></tr>
<tr><td>24.</td><td>130 MW, 0.75 p.f. lagging</td></tr>
<tr><td>25.</td><td>140 MW, 0.70 p.f. lagging</td></tr>
</table>
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>2.</td><td>An isolated power station has the LFC system with the following parameters:
Turbine time constant = 0.5 sec
Governor time constant = 0.25 sec
Generator time constant = 8 sec
Governor speed regulation = R pu
The load varied as ‘D’ tabulated below:
a) Use Routh stability criterion to determine the range of ‘R’
b) The governor speed regulation is set to R = 0.04 pu. The turbine rated output is 200 MW at a nominal frequency of 60 Hz. A sudden load increase as tabulated below:
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>D</th><th>Sudden Increased load</th></tr>
<tr><td>21.</td><td>0.80</td><td>30 MW</td></tr>
<tr><td>22.</td><td>0.90</td><td>40 MW</td></tr>
<tr><td>23.</td><td>1.00</td><td>50 MW</td></tr>
<tr><td>24.</td><td>1.10</td><td>60 MW</td></tr>
<tr><td>25.</td><td>1.20</td><td>70 MW</td></tr>
</table>
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>3.</td><td>Explain preventive and emergency control in power system with suitable example.
(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>4.</td><td>Draw and explain energy control centre of India in detail.
(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>5.</td><td>For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:
$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$
Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:</td><td>4</td><td>5</td><td>10</td></tr>
</table>

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<table>
<tr><td></td><td>

$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>21.</td><td>900</td></tr>
<tr><td>22.</td><td>905</td></tr>
<tr><td>23.</td><td>910</td></tr>
<tr><td>24.</td><td>915</td></tr>
<tr><td>25.</td><td>920</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td><td></td><td></td><td></td></tr>
<tr><td>6.</td><td>

The fuel cost in $/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>21.</td><td>125</td></tr>
<tr><td>22.</td><td>130</td></tr>
<tr><td>23.</td><td>135</td></tr>
<tr><td>24.</td><td>140</td></tr>
<tr><td>25.</td><td>145</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

</td><td>4</td><td>5</td><td>10</td></tr>
</table>

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Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-VI)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>A three-phase transmission line has a resistance per phase of 5 ohm and inductive reactance per phase of 12 ohm and line voltage at the receiving end is 33 KV. a) Determine voltage at the sending end when the load at the receiving end is tabulated below:
Different Data for Experiment
<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>26.</td><td>10 MVA, 0.90 p.f. lagging</td></tr>
<tr><td>27.</td><td>15 MVA, 0.85 p.f. lagging</td></tr>
<tr><td>28.</td><td>20 MVA, 0.80 p.f. lagging</td></tr>
<tr><td>29.</td><td>25 MVA, 0.75 p.f. lagging</td></tr>
<tr><td>30.</td><td>30 MVA, 0.70 p.f. lagging</td></tr>
</table>
b) The voltage at the sending end is maintained constant at 36 KV by means of a synchronous phase modifier at the receiving end, which has the same rating at zero load at the receiving end as for the load tabulated below:
Different Data for Experiment
<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>26.</td><td>10 MW</td></tr>
<tr><td>27.</td><td>15 MW</td></tr>
<tr><td>28.</td><td>20 MW</td></tr>
<tr><td>29.</td><td>25 MW</td></tr>
<tr><td>30.</td><td>30 MW</td></tr>
</table>
Determine the power factor of the full-load output and the rating of the synchronous phase modifier.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>2.</td><td>An isolated power station has the LFC system with the following parameters:
Turbine time constant = 0.5 sec
Governor time constant = 0.25 sec
Generator time constant = 8 sec
Governor speed regulation = R pu
The load varied as ‘D’ tabulated below:
c) Use Routh stability criterion to determine the range of ‘R’
d) The governor speed regulation is set to R = 0.05 pu. The turbine rated output is 200 MW at a nominal frequency of 60 Hz. A sudden load increase as tabulated below:
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>D</th><th>Sudden Increased load</th></tr>
<tr><td>26.</td><td>1.20</td><td>30 MW</td></tr>
<tr><td>27.</td><td>1.30</td><td>40 MW</td></tr>
<tr><td>28.</td><td>1.40</td><td>50 MW</td></tr>
<tr><td>29.</td><td>1.50</td><td>60 MW</td></tr>
<tr><td>30.</td><td>1.60</td><td>70 MW</td></tr>
</table>
(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>3.</td><td>Explain preventive and emergency control in power system with suitable example.
(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)</td><td>3</td><td>4</td><td>10</td></tr>
<tr><td>4.</td><td>Draw and explain energy control centre of India in detail.</td><td>3</td><td>4</td><td>10</td></tr>
</table>

Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

<table>
<tr><td></td><td>(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)</td><td></td><td></td><td></td></tr>
<tr><td>5.</td><td>
For the optimal dispatch and the total cost in $/hr. for thermal power plant is given by:

$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$

Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:

$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>26.</td><td>925</td></tr>
<tr><td>27.</td><td>930</td></tr>
<tr><td>28.</td><td>935</td></tr>
<tr><td>29.</td><td>940</td></tr>
<tr><td>30.</td><td>945</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td><td>4</td><td>5</td><td>10</td></tr>
<tr><td>6.</td><td>
The fuel cost in $/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>26.</td><td>150</td></tr>
<tr><td>27.</td><td>155</td></tr>
<tr><td>28.</td><td>160</td></tr>
<tr><td>29.</td><td>165</td></tr>
<tr><td>30.</td><td>170</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)
</td><td>4</td><td>5</td><td>10</td></tr>
</table>

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Faculty Name	Mr. Ajay Bhardwaj

Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-VII)

<table>
<tr><th>Q.</th><th>Question</th><th>BL</th><th>CO</th><th>MM</th></tr>
<tr><td>1.</td><td>A three-phase, 50 Hz transmission line has the following values per phase per km: R = 0.25 ohm, L = 2 mH, C = 0.014 µF. The line is 50 km long, the voltage at the receiving end is 132 KV and the power delivered is tabulated below:
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>load</th></tr>
<tr><td>31.</td><td>60 MVA, 0.90 p.f. lagging</td></tr>
<tr><td>32.</td><td>65 MVA, 0.85 p.f. lagging</td></tr>
<tr><td>33.</td><td>70 MVA, 0.80 p.f. lagging</td></tr>
<tr><td>34.</td><td>75 MVA, 0.75 p.f. lagging</td></tr>
<tr><td>35.</td><td>80 MVA, 0.70 p.f. lagging</td></tr>
</table>
If the voltage at the sending end is maintained at 140 KV by a synchronous phase modifier at the receiving end, determine the KVAR of this machine a) with no load b) with full load at the receiving end.
(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>2.</td><td>An isolated power station has the LFC system with the following parameters:
Turbine time constant = 0.5 sec
Governor time constant = 0.2 sec
Generator time constant = 5 sec
Governor speed regulation = R pu
The load varied as ‘D’ tabulated below:
e) Use Routh stability criterion to determine the range of ‘R’
f) The governor speed regulation is set to R = 0.04 pu. The turbine rated output is 250 MW at a nominal frequency of 60 Hz. A sudden load increase as tabulated below:
Table: Different Data for Experiment
<table>
<tr><th>S. No.</th><th>D</th><th>Sudden Increased load</th></tr>
<tr><td>36.</td><td>1.20</td><td>30 MW</td></tr>
<tr><td>37.</td><td>1.30</td><td>40 MW</td></tr>
<tr><td>38.</td><td>1.40</td><td>50 MW</td></tr>
<tr><td>39.</td><td>1.50</td><td>60 MW</td></tr>
<tr><td>40.</td><td>1.60</td><td>70 MW</td></tr>
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(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)</td><td>4</td><td>3</td><td>10</td></tr>
<tr><td>3.</td><td>Explain preventive and emergency control in power system with suitable example.
(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)</td><td>3</td><td>4</td><td>10</td></tr>
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Faculty Name	Dr. Dhanraj Chitara
Faculty Name	Mr. Ajay Bhardwaj

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<td>

For the optimal dispatch and the total cost in \$/hr. for thermal power plant is given by:

$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$
$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$
$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$

Where P_1, P_2 and P_3 are in MW and total demand is tabulated below with following generation limits:

$$200 \le P_1 \le 450$$
$$150 \le P_2 \le 350$$
$$100 \le P_3 \le 225$$

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>31.</td><td>950</td></tr>
<tr><td>32.</td><td>955</td></tr>
<tr><td>33.</td><td>960</td></tr>
<tr><td>34.</td><td>965</td></tr>
<tr><td>35.</td><td>970</td></tr>
</table>

(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)

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<td>5</td>
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The fuel cost in \$/hr. of three power plants are given by:

$$C_1 = 200 + 7.0P_1 + 0.008P_1^2$$
$$C_2 = 180 + 6.3P_2 + 0.009P_2^2$$
$$C_3 = 140 + 6.8P_3 + 0.007P_3^2$$

Where P_1, P_2 and P_3 are in MW. Plant outputs are subjected to the following limits (MW):

$$10 \le P_1 \le 85$$
$$10 \le P_2 \le 80$$
$$10 \le P_3 \le 70$$

For this problem, assume the real power loss is given by the simplified expression:

$$P_L(pu) = 0.0218P_1^2(pu) + 0.0228P_2^2(pu) + 0.0179P_3^2(pu)$$

Where loss coefficients are specified in pu on a 100 MVA base. Determine the optimal dispatch of the generation and total fuel cost when the total system load is tabulated below using iteration methods.

Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Total system load</th></tr>
<tr><td>31.</td><td>175</td></tr>
<tr><td>32.</td><td>180</td></tr>
<tr><td>33.</td><td>185</td></tr>
<tr><td>34.</td><td>190</td></tr>
<tr><td>35.</td><td>195</td></tr>
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Swami Keshvanand Institute of Technology, Management &Gramothan, Jaipur
Department of Electrical Engineering

Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

(Set-VIII)

Q.	Question	BL	CO	MM
1.	A three-phase overhead line has the following general parameters: $\overrightarrow{A} = 0.8705, \angle 2.3,$ $\overrightarrow{B} = 187, \angle 75.1$ Find the MVAR rating on on-load and full-load of a synchronous phase modifier to maintain the voltages constant at 154 KV at both ends. The load at the receiving end is tabulated below. Also, determine the maximum load that can be transmitted. **Table: Different Data for Experiment** S. No. / load **36.** 40 MVA, 0.70 p. f. lagging **37.** 50 MVA, 0.75 p. f. lagging **38.** 60 MVA, 0.80 p. f. lagging **39.** 70 MVA, 0.85 p. f. lagging **40.** 80 MVA, 0.90 p. f. lagging **41.** 90 MVA, 0.95 p. f. lagging **(Reference: Electrical Power System by AShfaq Husain, CBS Pub.)**	4	3	10
2.	An isolated power station has the LFC system with the following parameters: Turbine time constant = 0.5 sec Governor time constant = 0.2 sec Generator time constant = 5 sec Governor speed regulation = R pu The load varied as 'D' tabulated below: g) Use Routh stability criterion to determine the range of 'R' h) The governor speed regulation is set to R = 0.05 pu. The turbine rated output is 250 MW at a nominal frequency of 60 Hz. A sudden load increase as tabulated below: **Table: Different Data for Experiment** S. No. / D / Sudden Increased load **41.** 0.80 / 30 MW **42.** 0.90 / 40 MW **43.** 1.00 / 50 MW **44.** 1.10 / 60 MW **45.** 1.20 / 70 MW **46.** 1.30 / 80 MW **(Reference: Power System Analysis by Hadi Saadat, TMH Pub.)**	4	3	10
3.	Explain preventive and emergency control in power system with suitable example. **(Reference: https://archive.nptel.ac.in/courses/108/101/108101040/)**	3	4	10
4.	Draw and explain energy control centre of India in detail. **(Reference: https://www.youtube.com/watch?v=Trj33GHuEFI)**	3	4	10

Table for Question 1:

Table: Different Data for Experiment

S. No.	load
36.	40 MVA, 0.70 p. f. lagging
37.	50 MVA, 0.75 p. f. lagging
38.	60 MVA, 0.80 p. f. lagging
39.	70 MVA, 0.85 p. f. lagging
40.	80 MVA, 0.90 p. f. lagging
41.	90 MVA, 0.95 p. f. lagging

Table for Question 2:

Table: Different Data for Experiment

S. No.	D	Sudden Increased load
41.	0.80	30 MW
42.	0.90	40 MW
43.	1.00	50 MW
44.	1.10	60 MW
45.	1.20	70 MW
46.	1.30	80 MW

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Assignment Sheet-II Session 2023-24 (Even Semester)

Subject: Power System-II (6EE4-02) **Max Marks- 40**

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Table: Different Data for Experiment

<table>
<tr><th>S. No.</th><th>Power Demand</th></tr>
<tr><td>36.</td><td>975</td></tr>
<tr><td>37.</td><td>980</td></tr>
<tr><td>38.</td><td>985</td></tr>
<tr><td>39.</td><td>990</td></tr>
<tr><td>40.</td><td>995</td></tr>
<tr><td>41.</td><td>1000</td></tr>
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<tr><td>36.</td><td>200</td></tr>
<tr><td>37.</td><td>205</td></tr>
<tr><td>38.</td><td>210</td></tr>
<tr><td>39.</td><td>215</td></tr>
<tr><td>40.</td><td>220</td></tr>
<tr><td>41.</td><td>225</td></tr>
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