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**KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR**  
**23EE28PC603**

**III B. Tech II Semester Regular Examinations, April/May- 2026**  
**POWER SYSTEM OPERATION AND CONTROL**  
**(EEE)**

Time: 3 Hours

Max. Marks: 60

Note: Question paper consists of Part-A &amp; Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- **Part A** is compulsory, consisting of 10 sub questions from all units carrying equal marks.
- **Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.

| <b>PART-A (10Marks)</b> |                                                                                                                                                                                            |              |            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|
| <b>Q. No</b>            | <b>Questions</b>                                                                                                                                                                           | <b>Marks</b> | <b>BTL</b> |
| <b>1.a)</b>             | Define load flow studies in power systems.                                                                                                                                                 | <b>1M</b>    | <b>1</b>   |
| <b>1.b)</b>             | Explain the need for load flow studies in power system operation.                                                                                                                          | <b>1M</b>    | <b>2</b>   |
| <b>1.c)</b>             | Explain the concept of distribution of load between generating units                                                                                                                       | <b>1M</b>    | <b>2</b>   |
| <b>1.d)</b>             | What are loss coefficients in power systems?                                                                                                                                               | <b>1M</b>    | <b>1</b>   |
| <b>1.e)</b>             | What is meant by control area in power systems?                                                                                                                                            | <b>1M</b>    | <b>1</b>   |
| <b>1.f)</b>             | Explain the need for power and frequency control in a power system.                                                                                                                        | <b>1M</b>    | <b>2</b>   |
| <b>1.g)</b>             | Define power system stability.                                                                                                                                                             | <b>1M</b>    | <b>1</b>   |
| <b>1.h)</b>             | Explain the equal area criterion for stability analysis.                                                                                                                                   | <b>1M</b>    | <b>2</b>   |
| <b>1.i)</b>             | Define SCADA in power systems.                                                                                                                                                             | <b>1M</b>    | <b>1</b>   |
| <b>1.j)</b>             | Explain the functions of SCADA in power system operation.                                                                                                                                  | <b>1M</b>    | <b>2</b>   |
| <b>PART-B (50Marks)</b> |                                                                                                                                                                                            |              |            |
| <b>Q.No</b>             | <b>Questions</b>                                                                                                                                                                           | <b>Marks</b> | <b>BTL</b> |
| <b>2. a)</b>            | Explain the necessity of a load flow solution. Derive the necessary equations for the load flow problem.                                                                                   | <b>5M</b>    | <b>4</b>   |
| <b>b)</b>               | Explain the Newton Raphson Load flow method in polar form, and derive the equations to compute the Jacobian matrix elements.                                                               | <b>5M</b>    | <b>4</b>   |
| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>3.</b>               | Explain the algorithm to perform load flow using the Gauss-Seidel method.                                                                                                                  | <b>10M</b>   | <b>3</b>   |
| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>4.</b>               | Explain briefly the coordination between LFC and Economic Dispatch                                                                                                                         | <b>10M</b>   | <b>2</b>   |
| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>5. a)</b>            | The cost characteristic of two units in a plant are: $C_1=0.4P_1^2+160P_1+K_1$ Rs/h; $C_2=0.45P_2^2+120P_2+K_2$ Rs/h. where $P_1$ and $P_2$ are power outputs in MW. Find the optimum load | <b>5M</b>    | <b>3</b>   |

|              |                                                                                                                                                                                                                                                                     |            |          |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------|
|              | allocation between the two units, when the total load is 162.5 MW. What will be the daily loss if the units are loaded equally?                                                                                                                                     |            |          |
| <b>b)</b>    | Explain mathematically about economical division of plant load between generating units in a plant.                                                                                                                                                                 | <b>5M</b>  | <b>4</b> |
| <b>6. a)</b> | Derive the model of speed governing system and hence draw its block diagram.                                                                                                                                                                                        | <b>6M</b>  | <b>4</b> |
| <b>b)</b>    | A 100 MVA synchronous generator operates on full load at a frequency of 50 Hz. The load is suddenly reduced to 50 MW. Due to time lag in governor system, the steam valve begins to close after 0.4 sec. Determine the change in frequency that occurs in this time | <b>4M</b>  | <b>3</b> |
| <b>OR</b>    |                                                                                                                                                                                                                                                                     |            |          |
| <b>7. a)</b> | What are the basic requirements needed for control strategy in Load Frequency Control (LFC) system.                                                                                                                                                                 | <b>5M</b>  | <b>2</b> |
| <b>b)</b>    | Obtain the mathematical modelling of tie line power in an inter connected system and its block diagram                                                                                                                                                              | <b>5M</b>  | <b>4</b> |
| <b>8. a)</b> | State and explain equal area criterion.                                                                                                                                                                                                                             | <b>5M</b>  | <b>2</b> |
| <b>b)</b>    | Discuss the step by step solution of a swing equation                                                                                                                                                                                                               | <b>5M</b>  | <b>3</b> |
| <b>OR</b>    |                                                                                                                                                                                                                                                                     |            |          |
| <b>9. a)</b> | The power angle characteristic for a generator supplying infinite bus is given by $P_e = 1.25 \sin \delta$ . The H constant is 5 sec and initially it is delivering a load of 0.5 p.u. Find the critical clearing angle.                                            | <b>5M</b>  | <b>3</b> |
| <b>b)</b>    | What are the various methods of improving steady state stability? Explain.                                                                                                                                                                                          | <b>5M</b>  | <b>2</b> |
| <b>10.</b>   | Explain the need for computer control of power systems. Also, explain its functioning                                                                                                                                                                               | <b>10M</b> | <b>2</b> |
| <b>OR</b>    |                                                                                                                                                                                                                                                                     |            |          |
| <b>11.</b>   | Draw the block diagram of the SCADA system, and briefly describe the major components of a SCADA system                                                                                                                                                             | <b>10M</b> | <b>3</b> |

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| <b>PART-A (10Marks)</b> |                                                                                                                                                                                            |              |            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|
| <b>Q. No</b>            | <b>Questions</b>                                                                                                                                                                           | <b>Marks</b> | <b>BTL</b> |
| <b>1.a)</b>             | Define load flow studies in power systems.                                                                                                                                                 | <b>1M</b>    | <b>1</b>   |
| <b>1.b)</b>             | Explain the need for load flow studies in power system operation.                                                                                                                          | <b>1M</b>    | <b>2</b>   |
| <b>1.c)</b>             | Explain the concept of distribution of load between generating units                                                                                                                       | <b>1M</b>    | <b>2</b>   |
| <b>1.d)</b>             | What are loss coefficients in power systems?                                                                                                                                               | <b>1M</b>    | <b>1</b>   |
| <b>1.e)</b>             | What is meant by control area in power systems?                                                                                                                                            | <b>1M</b>    | <b>1</b>   |
| <b>1.f)</b>             | Explain the need for power and frequency control in a power system.                                                                                                                        | <b>1M</b>    | <b>2</b>   |
| <b>1.g)</b>             | Define power system stability.                                                                                                                                                             | <b>1M</b>    | <b>1</b>   |
| <b>1.h)</b>             | Explain the equal area criterion for stability analysis.                                                                                                                                   | <b>1M</b>    | <b>2</b>   |
| <b>1.i)</b>             | Define SCADA in power systems.                                                                                                                                                             | <b>1M</b>    | <b>1</b>   |
| <b>1.j)</b>             | Explain the functions of SCADA in power system operation.                                                                                                                                  | <b>1M</b>    | <b>2</b>   |
| <b>PART-B (50Marks)</b> |                                                                                                                                                                                            |              |            |
| <b>Q.No</b>             | <b>Questions</b>                                                                                                                                                                           | <b>Marks</b> | <b>BTL</b> |
| <b>2. a)</b>            | Explain the necessity of a load flow solution. Derive the necessary equations for the load flow problem.                                                                                   | <b>5M</b>    | <b>4</b>   |
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| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>3.</b>               | Explain the algorithm to perform load flow using the Gauss-Seidel method.                                                                                                                  | <b>10M</b>   | <b>3</b>   |
| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>4.</b>               | Explain briefly the coordination between LFC and Economic Dispatch                                                                                                                         | <b>10M</b>   | <b>2</b>   |
| <b>OR</b>               |                                                                                                                                                                                            |              |            |
| <b>5. a)</b>            | The cost characteristic of two units in a plant are: $C_1=0.4P_1^2+160P_1+K_1$ Rs/h; $C_2=0.45P_2^2+120P_2+K_2$ Rs/h. where $P_1$ and $P_2$ are power outputs in MW. Find the optimum load | <b>5M</b>    | <b>3</b>   |

|              |                                                                                                                                                                                                                                                                     |            |          |
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|              | allocation between the two units, when the total load is 162.5 MW. What will be the daily loss if the units are loaded equally?                                                                                                                                     |            |          |
| <b>b)</b>    | Explain mathematically about economical division of plant load between generating units in a plant.                                                                                                                                                                 | <b>5M</b>  | <b>4</b> |
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| <b>b)</b>    | Discuss the step by step solution of a swing equation                                                                                                                                                                                                               | <b>5M</b>  | <b>3</b> |
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| <b>OR</b>    |                                                                                                                                                                                                                                                                     |            |          |
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