I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
ADVANCED POWER SYSTEM OPERATION AND CONTROL

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a) Explain Newton's method of economic dispatch.   **7M**
    b) Discuss the base point & participation factors method of economic load dispatch.
                                                                                     7M

2. a) What is unit commitment problem? Discuss the constraints in unit commitment.
                                                                                     6M
    b)Explain the lagrange relaxation technique of unit commitment solution.   **8M**

3. a) Explain in detail long-range and short-range hydro scheduling.   **7M**
    b) A Hydro plant and a steam plant supply a constant load of 90W for one week. The unit characteristics are
    Hydro plant: q= 300 + 15$P_H$acre –ft/hr; $0 \leq P_H \leq 100MW$
    Steam plant: $H_s = 53.25 + 11.27 P_s + 0.0213 P_s^2$acre –ft/hr; $12.5 \leq P_s \leq 50MW$
    If the hydro plant is limited 10 GWh of energy, find the run time of the steam unit T_s^*
                                                                                     7M

4. a) Explain the Gradient approaches Hydro-Thermal scheduling.   **6M**
    b) Explain the Dynamic programming solution technique to Hydro Thermal scheduling problem.   **8M**

5. a) Describe the application of OPF.   **6M**
    b) Explain Newton's method of OPF solution.   **8M**

6. a) Explain the flow diagram of security constrained OPF.   **7M**
    b) What is linear Sensitively Analysis? Explain.   **7M**

7. a) Explain the four operating states of Power system.   **6M**
    b) Explain the bounding technique of AC network Analysis.   **8M**

8. a) Explain the objectives of AGC.   **6M**
    b) Explain the preventive & emergency control problems in Two-area systems.   **8M**

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
OPTIMIZATION TECHNIQUES

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a) State an optimization problem. Give any five Engineering applications of optimization. **7M**
    b) Find minimum value of the function $f(X_1, X_2) = X_1^2 + X_2^2 - 10 X_1 - 10X_2$ satisfying the constraints $X_1 + X_2 \leq 9$, $X_1 - X_2 \geq 6$ and $X_1, X_2 \geq 0$ using Lagrangian multipliers.   **7M**

2. An advertising company has to plan their advertising strategy through the different media, namely TV, Radio and Newspaper. The purpose of advertising is to reach maximum number of potential customers. The cost of an advertisement in TV, Radio and Newspaper are Rs 3000/-, Rs2000/- and Rs2500/- respectively. The average expected potential customers reached per unit by 20000 of which 15000 are female customers. These figures with Radio are 60000 and 40000 and with Newspaper 25000 and 12000 respectively. The company has a maximum budget for advertising is Rs50000/- only. It is proposed to advertise through TV or Radio between 6 and 10 units and atleast 5 advertisements should appear in Newspaper. Further it decides that atleast 100000 exposures should take place among female customers. Budget of advertising by Newspaper is limited to Rs25000/- only. Formulate into linear programming problem and solve it by using simplex method.   **14M**

3. Minimize $Z = X_1 - X_2 + 2X_1^2 + 2 X_1X_2 + X_2^2$ with the starting point (0,0) using the univariate method.   **14M**

4. a) What is Two-Phase simplex method? Explain the same with necessary steps.   **7M**

    b) Solve the following linear programming problem   **7M**
        Minimize $Z = 2X_1 + 9X_2 + 24X_3 + 8 X_4 + 5X_5$
        Subject to $X1 + X_2 + 2X_3 - X_5 - X_6 = 1$
                    $-2 X_1 + X_3 + X_4 + X_5 - X_7 = 2$
        And $X_i \geq 0$, i = 1,2,3,4,5,6,7

5. a) State Kuhn- Tucker conditions.   **7M**
    b) Minimize $f(X_1, X_2) = (X_1 - 1)^2 + (X_2 - 5)^2$
       Subject to $-X_1^2 + X_2 \leq 4$
                   $-(X_1 - 2)^2 + X_2 \leq 3$ by Kuhn- Tucker conditions.   **7M**

6. Solve the following problem by Powell's method (Use pattern search directions)
    Minimize $f(X_1, X_2) = 4X_1^2 + 3X_2^2 - 5 X_1X_2 - 8X_1$ from starting point (0, 0).   **14M**

7. a) While solving the linear programming problem, explain how you would select a basic variable that should become a non- basic variable?   **7M**
    b) Solve the following Linear Programming Problem by Revised simplex method.
       Maximize $Z = 5X_1 + 3X_2$
        Subject to $4X1 + 5X_2 \geq 10$ **7M**
                    $5X_1 + 2X_2 \leq 10$
                    $3X_1 + 8X_2 \leq 12$
        And $X_1, X_2 \geq 0$

8. a) Minimize $f(X_1, X_2) = 2X_1^2 + X_2^2$ by using the Steepest Descent Method with the starting point (1, 2). **7M**

b) Write any Two of the following **7M**
    (i) Broyden- Fletcher- Goldfarb- Shanno method
    (ii) Zoutendijk's method
    (iii) Marquardt method
    (iv) Fibonacci method

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
ADVANCED DRIVES AND CONTROL

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a) Derive the Transfer Functions of DC Motors.   **7M**
    b) Explain in detail about the armature current waveform and torque pulsations.   **7M**

2. a) Explain the d-q equivalent circuit of induction motor.   **7M**
    b) Explain about the impact of non- sinusoidal excitation of induction motor   **7M**

3.   Explain about time and space harmonics in the induction motor.   **14M**

4. a) Explain about small signal modeling of the induction motor.   **7M**

    b) Explain about direct and indirect vector control of induction motor.   **7M**

5. Explain about Direct torque Control of induction motor with waveforms.   **14M**

6. a) Explain about the d-q equivalent of Synchronous motor with necessary circuit
    diagrams.   **7M**
    b) Explain in detail about Permanent magnet motors and Switched reluctance motors.
                                                                                            7M

7. a) Explain the design of P, PI and PID values in closed loop control of motors.   **7M**
    b) Explain in detail about microcomputer control of dc drive.   **7M**

8. Derive the d-q equivalent of synchronous reluctance wound field and sinusoidal
    permanent magnet motors.   **14M**

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
ADVANCED CONTROL SYSTEM DESIGN

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1) A) Explain procedural steps to design a lag-lead compensator network in frequency
domain.   **6M**

   B) Design a compensator for the system having OLTF

   $G_f(s) = \dfrac{10}{s(s+1)}$ .It is specified that damping ratio=0.5 and Wn=3 rad/sec.   **8M**

2) The open loop transfer function of the system is given by

   $G_f(s) = \dfrac{k}{s(s+1)(s+4)}$ .Design lag-lead compensator so that phase margin≥40 and steady state

   error for unit ramp input≤0.04.   **14M**

3) A) Explain about parameter optimization using ISE criterion.   **6M**
   B) Consider the system where

   $G_f(s) = \dfrac{W_n}{s^2 + 2\varepsilon W_n s + W_n^2}$

   For a step input it is designed to have an output which follows the input closely. Assuming
   that Wn is a fixed parameter, determine what value of ϵ should be used to produce minimum
   ISE.   **8M**

4) A) Explain the procedural steps for state variable feedback method.   **6M**
   B) Obtain a state variable feedback compensation for the system having OLTF

   $G(s) = \dfrac{1}{s(s+1)(s+4)}$. It is specified that damping ratio=0.5,Wn=2 rad/sec.   **8M**

5) Give the mathematical formulation of linear quadratic regulator and explain in detail with
   relevant example.   **14M**

6) A) Explain the tuning procedure given by Ziegler Nicholas method.   **7M**
   B) Explain the effect of differential controller on the plant in a multi loop system and
   modified characteristics.   **7M**

7) A) Explain necessity of deadbeat compensator and state an example.   **6M**
   B) A fixed plant of sampled data system is given by

   $Gf(s) = \dfrac{2(1-e^{st})}{s(s+1)(s+2)}$

   Find the digital compensator which gives deadbeat response for step input.   **8M**

8) A) Explain the need of compensating networks.   **6M**

   B) Explain about w–plane method of compensating a plant.   **8M**

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
RENEWABLE ENERGY SYSTEMS

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a) List various conventional and Non conventional energy sources.   **7M**
    b) Explain the role of renewable energy sources with respect to Indian scenario.   **7M**

2. a) With a neat schematic explain about nuclear power generation .   **7M**
    b) Derive an expression for power produced by wind from fundamentals.   **7M**

3. a) Draw the characteristics of a P-V cell.   **7M**
    b) What is wave power?   **7M**

4. a) With a neat diagram explain the Hydroelectric power plant.   **7M**
    b) Write a brief note on surge absorber and penstock.   **7M**

5. a) What is meant by dynamic frequency control and why it is needed?   **7M**
    b) How does the reliability of system is affected by use of renewable energy sources?
                                                                                7M

6. Write short note on following
    a) Distributed generation   **7M**
    b) Various issues related with embedded generation.   **7M**

7. a) What are various costs associated with electricity generation.   **7M**
    b) Discuss about electric trading?   **7M**

8.   What is the future of various renewable energy sources in India?   **14M**

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
POWER SYSTEM MODELING

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1 (a). Describe the need for modelling of power system with examples.   **7M**

  (b). Describe the modelling of various transformers.   **7M**

2(a). Explain D-Q transformation using alfa and beta variables in SVC.   **7M**

  (b).What are the different types of SVC and their charcaterstics.   **7M**

3(a). Derive the stator voltage equations and rotor voltage equations from the
abc frame of reference to dqo reference frame.   **7M**

(b) Why park's transformation is required? Apply it to transform electrical and mechanical
equations of synchronous machine.   **7M**

4.(a). Explain dynamic performance of three phase fault in induction machines. **7M**

  (b). Describe the steady state operation of induction machine.   **7M**

5(a). Explain static and rotating reference frame.   **7M**

  (b). Explain transmission line modelling with T and Pi method.   **7M**

6(a). Derive crtitical clearing time in three phase fault in synchronous machine. **7M**

  (b). Explain the torque variations in synchronous machines.   **7M**

7(a). Explain the modelling of reheat and non reheat turbines in power systems. **7M**

  (b) Explain the modelling of Boilers in power systems.   **7M**

8(a). Explain the staedy state analysis of synchronous mchine.   **7M**

  (b). Explain the free acceleration characterstics of induction mahines.   **7M**

[M16 PS 1106]

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I/II M.Tech. I Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
POWER SYSTEM PLANNING

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a)Explain Lease Cost Planning with flowchart.   **7M**
    b)Describe the two techniques of load forecasting in power system.   **7M**

2. a) With the help of block diagram, explain distributed power generation planning. List
    plan options, uncertainties and attributes.   **7M**
    b) What is co-generation? Describe the two techniques of cogeneration. **7M**

3. a) Discuss wheeling in power system and list the typical objectives in wheeling.   **7M**
    b)What are the source of absorption and generation of reactive power in transmission
    and distribution lines? Compare advantages and disadvantages of any 4 compensating
    equipments.   **7M**

4.   a) Define system reliability and explain reliability planning criteria.   **7M**
         b) Explain in brief the following real time operations: **7M**
           a. State estimation.
           b. AGC
           c. Economic load dispatch
           d. Stability.

5. a)With the help of schematic diagram, explain load management technique.   **7M**
    b) Explain reactive power balance in power system   **7M**

6.   a) With the help of block diagram, explain computerized management of
     power   system.   **7M**
    b) Develop mathematical objective function of power system expansion planning.
                                                                          7M

7. a) What are the constraints observed during optimization process of
       power system   expansion planning?   **7M**
    b) Explain least cost optimization problem.   **7M**

8.   a) Explain in brief two optimization techniques.   **7M**
         b) Discuss the different planning tools.   **7M**

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
POWER SYSTEMS DYNAMICS AND STABILITY

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. a) List out the basic assumption usually considered in classical methods. **7M**
   b) Define Power system stability and explain in detail different types of stability. **7M**

2. a) Draw the Type ACI excitation system and brief the significance of various blocks.
   7M
   b) Write short notes on exciter saturation function **7M**

3. From the basics, develop the park's transformation equations for stator voltages and rotor flux linkages. **14M**

4. Explain in detail about the various static and dynamic load representations. **14M**

5. Prove that, if the armature flux linkage components, with respect to a synchronously rotating reference frame, are constants, then the transformer emf terms ($p\psi_d$ and $p\psi_q$) and terms introduced by the variations in the rotor speed cancel each other. **14M**

6. Explain the procedure for application of R-H criterion to the small signal analysis of SMIB system. **14M**

7. a) What is the function of PSS. **7M**
   b) Draw the block diagram of conventional PSS and explain various blocks of PSS in the SMIB system. **7M**

8. a) List out the various assumptions in multi-machine stability analysis. **7M**
   b) Explain COI calculation in multi-machine stability. **7M**

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
AUTOMATION IN POWER SYSTEMS

Time: 3 Hours   Max. Marks: 70

Answer any five questions
All question carry equal marks

1. (a) Explain the purpose of automation in power systems.   **7M**
   (b) Explain the essential relaying devices.   **7M**

2. (a) Explain the power system operation functions required at the control centre.
                                                                     6M
   (b) Discuss the principles of SCADA.   **8M**

3. (a) What are the problems with existing distribution systems? Discuss the need for
   distribution automation.   **7M**
   (b) Discuss the characteristics and objectives of distribution automation.   **7M**

4. (a) Describe the benefits of substation automation.   **6M**
   (b) What are the advantages of an EEM system?   **8M**

5. (a) What is network reconfiguration? Explain.   **7M**
   (b) Explain the means of voltage profile improvement in distribution feeders.
                                                                     7M

6. (a) Why man-machine interface is important in distribution automation?   **7M**
   (b) Describe the basic distribution management system functions. **7M**

7. Discuss a method for placing a capacitor in a distribution system with neat flow
   diagram.   **14M**
8. Define the following:
   (a)   Technical loss   **4M**
   (b)   Commercial loss   **4M**
   (c)   TXD loss and   **3M**
   (d)   AT&C loss   **3M**

[M16 PS 1202]

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
INTELLIGENT SYSTEMS AND CONTROL
Time: 3 Hours   Max. Marks: 70

Answer any five questions

All question carry equal marks

1. a) Compare the biological and artificial neural network with a neat sketch.   **7M**
    b) Explain briefly about the perceptron multilayer network with its algorithm.   **7M**

2. a) Write short notes on i) statistical learning, ii) Explanation based learning.   **7M**
    b) Mention the advantages of the back propagation algorithm.   **7M**

3. Explain operations on fuzzy sets with suitable examples.   **14M**

4. a) Discuss the different methods of defuzzification with examples.   **7M**
    b) Explain Fuzzy inference system of Mamadani and Sugeno methods.   **7M**

5. a) Two Fuzzy relations are given by

$$R= \begin{matrix} & Y_1 & Y_2 \\ X_1 & [0.6 & 0.5] \\ X_2 & [0.2 & 0.9] \end{matrix} \qquad S= \begin{matrix} & Z_1 & Z_2 & Z_3 \\ Y_1 & [1 & 0.5 & 0.3] \\ Y_2 & [0.8 & 0.4 & 0.7] \end{matrix}$$

   Obtain Fuzzy relations T as a composition between the fuzzy relations.   **7M**
    b) Discuss about Hybrid neural network based Fuzzy controller   **7M**

6. a).What is an artificial intelligent technique? How is it different from the technique of conventional programming?   **7M**
    b) Write briefly about the major areas of Artificial Intelligence.   **7M**

7. Let A = {(x$_1$,0.2), (x$_2$,0.7), (x$_3$,0.4)} and B = {(y$_1$,0.5),(y$_2$,0.6)} be two fuzzy sets defined on the universe of discourse X = {x$_1$,x$_2$,x$_3$} and{y$_1$,y$_2$} respectively. Find the Cartesian product of A and B and fuzzy relation R   **14M**

8.Write short notes on
    a) Static and Dynamic Properties of Fuzzy controller   **5M**
    b) Fuzzified RBF network   **5M**
    c) Hybrid learning   **4M**

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
OPTIMAL CONTROL THEORY

Time: 3 Hours   Max. Marks: 70

Answer any five questions

All question carry equal marks

1. a) What are the steps involved in finding solution of an optimal control problem?
   4M

   b) Find the external for the following function

   $$J(x)=\int_1^{t1}(2x + \frac{x^2}{2})dt$$
   x(1)=2, x(t1)=2, t1>1 is free   **10M**

2. Discuss about following problems for selection of a performance measure
   i)   Minimum fuel problem
   ii)   State regulator problem   **14M**

3. a) What are the three approaches an optimal control system design use?   **4M**
   b) Find the curve with minimum arc length between the point x(0)=0 and the curve
   θ(t)=$t^2 - 10t + 24$ **10M**

4. Find the points in the three dimensional Euclidean space that extremize the function
   f(x_1,x_2,x_3)=x_1^2+ x_2^{2+} x_3^2 and lie on the intersection of the surfaces
         $x_{3=}$ x_1 x_2+5, x_{1+} x_{2+} x_3=1   **14M**

5. To illustrate principle of calculus of variations discuss about a problem with terminal
   time t_1 free, x(t_1) specified.   **14M**

6. Suppose a system where $\dot{x}_1$(t)=x_2(t); $\dot{x}_2$(t)=u(t) is to be controlled to minimize the
   performance measure

   $$J(x,u) = \frac{1}{2}\int_0^2 u^2 \, dt$$
   Find a set of necessary conditions for optimal control.   **14M**

7. Discuss about principle of optimality in detail.   **14M**

8. With the help of flow chart explain the Steepest Descent method.   **14M**

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
HIGH VOLTAGE AC/DC TRANSMISSION

Time: 3 Hours   Max. Marks: 70

Answer any five questions

All question carry equal marks

1. a) Draw equivalent circuit of a long transmission line.   **7M**
   b) Derive the relation between sending and receiving end voltages and currents. **7M**

2. a) With respect to long transmission line, give physical interpretation of the terms 'characteristic impedance' and 'propogation constant'. **8M**

   b) What is meant by surge impedance?   **6M**

3. Write short note on reflection and refraction of travelling waves?   **14M**

4. a) What is the principle of HVDC system operation?   **7M**
   b) Discuss the technical and economic advantages of d.c. systems over a.c. systems
                                                                               7M

5. a) With a block schematic, explain the main components of a HVDC transmission system. **10M**
   b) Classify HVDC links?   **5M**

6. Draw the equivalent circuit of a 3 phase full wave bridge converter and the waveforms of voltages and currents. Obtain the expansion for average direct voltage of the converter. **14M**

7. a) Explain the basic principles of HVDC link control.   **7M**
   b) What are the factors that influence the selection of control?   **7M**

8. Discuss briefly on the modeling of HVDC system   **14M**

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POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
POWER QUALITY

Time: 3 Hours   Max. Marks: 70

Answer any five questions

All question carry equal marks

1. Define Power Quality? With neat sketches explain the power quality disturbances?
                                                                                                                          14M

2. a) Define interruptions? Write the causes for interruptions?   **7M**
   b) Write the remedies to improve power quality?   **7M**

3. Write the difference between medium and low voltage systems?   **14M**

4. Explain
     i)   short interruption   **4M**
     ii)   fuse saving   **5M**
     iii)   Voltage during interruption?   **5M**

5. Define phase angle jump. Derive an expression for magnitude and phase angle jump versus distance?   **14M**

6. Explain

    i.   Comparison of observation and reliability evaluation   **7M**
    ii.   Voltage magnitude events due to re-closing.   **7M**

7. a) Calculate the voltage sag in non-radial system?   **7M**
   b) Write the effect of load on voltage sag?   **7M**

8. Write short notes on
      i) IEC Electromagnetic Compatibility standards   **7M**
      ii) European voltage characteristics standards   **7M**

                                                                                                       [M16 PS 1206]

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I/II M.Tech. II Semester Regular Examinations
POWER SYSTEMS AND AUTOMATION
MODEL QUESTION PAPER
POWER ELECTRONIC APPLICATIONS IN POWER SYSTEMS

Time: 3 Hours   Max. Marks: 70

Answer any five questions

All question carry equal marks

1. a) Differentiate between HVDC and FACTS.   **7M**
    b) What are the factors affecting the loading capability of power system.   **7M**

2. a) Explain various types of FACTS controllers with definitions.   **7M**
    b) Explain the benefits from FACTS technologies.   **7M**

3. a) Draw and Explain the V-I characteristics of TCR and TSC.   **7M**
    b) Explain the voltage control of system using SVC.   **7M**

4. a) Describe the simplified analysis of 3-phase 6-pulse STATCOM.   **7M**
    b) Explain the operation of diode clamped multilevel inverter.   **7M**

5. a) Explain the operation of Phase shifting transformer(PST).   **7M**
    b) How the PST helps in damping of Low Frequency Power Oscillations.   **7M**

6. a) Describe the operation of TSSC and TCSC.   **7M**
    b) Explain the operation of GCSC and SSSC.   **7M**

7. a) Explain the operation of flying capacitor multilevel inverter.   **7M**
    b) Describe the analysis of a Six Pulse VSC Using Switching Functions.   **7M**

8. a) Describe the Control of Power Flow in AC Transmission Line.   **7M**
    b) Write short note on static VAR compensators.   **7M**

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