B.TECH (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
DIGITAL SIMULATION OF POWER SYSTEMS
FE432

Maximum Marks: 60
Credits 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No. 1(a)  Find $Z_{BUS}$ by addition of branch and link of the following figure 1 by
taking bus 1 as reference bus.

![Figure 1](image)

2 (a)  Find $Z_F^{abc}$, $Y_F^{abc}$, $Z_F^{012}$ and $Y_F^{012}$ for single line to ground fault.

2 (b)  Derive the current and voltage formulas for three phase to ground fault at
bus p by taking the voltage prior to the fault at bus p as $E_p(0)$.

OR

2'(a)  Show that $E_i^{abc} = E_i^{abc} - Z_{ip}^{abc} Y_F^{abc} (U + Z_{pp}^{abc} Y_F^{abc})^{-1} E_p^{abc}$;  $i \neq p$

2'(b)  Prove that the transformation matrix $T_S$ and $T_C$ diagonalizes and does not
diagonalize the nonsymmetric impedance matrix $Z_{pq}^{abc}$ for rotating element
respectively.

3  Develop the modelling of closed loop single area automatic load
frequency control (ALFC) including speed-governor system, turbine
(without reheat), frequency dependent load and PI controller.

4(a)  What is unit commitment? Discuss different Hydro-Thermal load
scheduling methods.

Contd...
4(b) Consider two plant system with no transmission losses as shown in figure 2. Is to supply a load shown in figure 3. The data is

\[ C_1 = (24 + 0.02P_1)P_1 \text{ Rs./hour} \]
\[ W_2 = (6 + 0.0025P_2)P_2 \text{ m}^3/\text{second} \]

The maximum capacity of hydro plant and steam plant is 360 MW and 250 MW respectively. Determine the operating schedules by assuming constant hydro generation, constant thermal generation and equal incremental plant costs so that 148.6905 million m$^3$ water is used during the 24 hour period.

![Diagram](image)

**OR**

4' What do you mean by penalty factor and incremental transmission loss? Derive the loss formula $P_L = [P_G]^T [B] [P_G] + [B_{01}] [P_G] + B_{00}$

5(a) Describe least square and weighted least square state estimation of power systems.

5(b) Write short notes on contingency analysis and power system security assessment.
Q.No. Answer All Questions
Symbols used have their usual meaning
Assume suitable value for any missing data

1.(a) Explain "Back to Back" and "Point to Point" HVDC links. Why is bipolar link a better choice? 4
1.(b) Draw a typical HVDC layout and explain their basic components. 8

OR

1'.(a) Discuss the technical and economic advantages of HVDC systems over EHV AC systems. 8
1'.(b) Give the necessity of converter transformer and harmonic filtering equipment in a converter station. 4
2.(a) What is meant by Peak Inverse Voltage (PIV), pulse number, valve rating and transformer rating? 8
2.(b) Show that rating of the valve used in Graetz's circuit is 2.094 Pd where Pd is dc power transmitted. 4
3.(a) With the help of neat sketches, analyse a six pulse rectifier bridge circuit with an overlap angle less than 60°. 8
3.(b) What is the necessity of having constant ignition angle (CIA), constant current (CC) and constant extinction angle (CEA) controllers at each converter station? 4

OR

3'. Explain in detail about the converter control characteristics of HVDC system. 12

4.(a) What are the objectives of FACTS? Differentiate between HVDC and FACTS Controller. 4
4.(b) Discuss the effect series and shunt compensation schemes on power transfer capacity. 8
5.(a) Draw the V-I characteristics of SVC. How is it useful in improving the stability of the system? 6
5.(b) Explain the principle, working and characteristic of any type of Static VAR compensator with a neat sketch. 6

OR

5'. What are the different modes of operation of TCSC? How to model it? Discuss its applications in detail. 12
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ENERGY MANAGEMENT AND AUTOMATION
EE-434

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | M.M.
---|---|---
1. | Consider a building with 10,000 square meters of floor space. It uses 2.0 million kWh and 6800 GJ of natural gas in one year. Find the Energy Utilization Index (EUI) for this facility. Consider the same building as above. The annual cost for electric energy is INR153,200 and the annual cost for natural gas is INR 52,500. Find the Energy Cost Index (ECI) for this facility. | [12]

OR

1'(a) | Write in detail about Energy Exchange and Power Market operation | [06]
1'(b) | Describe in Detail the 3 phases of Energy audit Process. | [06]

2. | Answer any two the following questions: | [06]
(a) | Describe in detail the basic components of a SCADA system. | [06]
(b) | Write a note on real time Monitoring and Control of Power Systems Using SCADA. | [06]
(c) | Describe in detail the differences between PLC and RTU. | [06]

3(a) | Describe the open systems interconnection model (OSI) or ISO model of SCADA. | [06]

OR

3(a') | Classify and describe in detail the 2 important protocols of SCADA. | [06]
3(b) | Write in detail the i) Architecture, ii) Classification and iii) Implementation of Power Automation using SCADA. | [06]
4(a) Classify and describe the components of Distribution Automation.

OR

4(a') Classify the tangible and intangible benefits of distribution automation system.

4(b) Write a detailed note on Automatic Meter Reading and suggest the implementation strategy in Indian scenario.

5(a) What are the tariff options for Demand side management (DSM).

OR

5(a') Write a detailed note on Implementation issues and strategies of DSM technique.

5(b) Write a detailed note on load management techniques in Demand side Management (DSM).
1. (a) Z transform is not a completely reversible process. Why?

(b) The closed loop transfer function of system is given as

$$ T(z) = \frac{3z^2 - 2z + 8}{z^3 + 0.5z^2 - 0.25z + 0.75} $$

Write two different state models for it and find the location of system poles from each of the models.

(c) Find the overall transfer function of the system shown in figure 1.

**Fig. 1**

**OR**

(c') Examine the stability of the following characteristic equation using Jury's stability criterion.

$$ D(z) = z^3 - 1.3z^2 + 0.85z - 0.5 $$

2. (a) Show that the phase variable representation yields a completely controllable state model for all values of \( a_i \). Where \( a_i \) are the coefficients of characteristic equation.

(b) A system is represented by its state model as: \( \dot{x} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} x, \ y = [1 \ 1] \ x \ )

Contd......2.
Consider a linear transformation defined as: \[ z = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix} \]
Develop a state model in \( z \) and show that the input/output relationship of the system remains unchanged under linear transformation. Assume the initial conditions as:
\[ x(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix} \]
(c) Show that instead of complete controllability, stabilizability is a more efficient requirement for controller design.

3. (a)
Define and explain: (i) Incidental and intentional non linearity (ii) Multiple modes of behaviour (iii) Singular point (iv) Finite blow-up time
(a') Discuss the significance of Describing Function as a linearization technique. Also explain the principle of stability analysis using describing function.

3. (b)
Derive the describing function of a relay with dead zone.

4. (a)
Derive the Liapunov's equation for Linear Time Invariant System.
(b) Describe the steps involved in constructing a Liapunov’s function using variable gradient method.
(c) Consider the system described by
\[ \ddot{y} + 0.5 \dot{y} + 2y = 0 \]
Determine the nature of singular points and comment on their stability.

4'. (a)
Define and explain:
(i) Local stability (ii) Global Asymptotic Stability (iii) Limit Cycle (iv) Autonomous system
(c) A unity feedback system is given by \( G(s) = \frac{1}{(s + 2)} \). Draw the isoclines and the phase trajectory for a step input of \( r(t) = u(t) \) for \( c(0) = -1, \dot{c}(0) = 0 \) where \( r(t) \) is the input and \( c(t) \) is the output.

5. (a)
Define and explain
i) Admissible control ii) Performance Measure iii) Fuzzy logic iv) Intelligent Control
(b) Draw and explain the Model Reference Adaptive Control scheme.
OR

5."(a)
Explain the Principle of Optimality and its significance in solving an optimal control problem
(b) Derive the Euler-Lagrange equation for solution of two point boundary value problem
2015-16
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
MICROPROCESSOR SYSTEMS AND APPLICATIONS
EE-473

Maximum Marks: 60       Credits: 04       Duration: Three Hours

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning.

1(a) Draw the block diagram of Intel 8085. What is the function of Instruction Register and Incrementor/Decrementor Latch in Intel 8085 architecture? (05)

1(b) For Intel 8085 microprocessor, write a program in assembly language to find the largest number from a series of numbers from 2001H to 2005H. The count of the numbers is stored at 2000H. Store the result at 2006H. (05)

1'(a) Classify the input/output signals of Intel 8085 in different groups. Also, write the functions of ALE and status lines. (06)

1'(b) For Intel 8085 microprocessor, write a program in assembly language to get the sum of a series of 8-bit numbers, sum is 16-bits. The series contains five 8-bit numbers stored from 3001H to 3005H. The count of the numbers is stored at 3000H. (06)

2(a) With the help of flow chart, explain interrupt driven data transfer scheme. Why it is better than asynchronous data transfer? (06)

2(b) Explain Memory mapped I/O scheme and I/O mapped I/O scheme, with reference to Intel 8085. (06)

3(a) Discuss Asynchronous/Interrupt driven operating mode of Intel 8255. (06)

3(b) Draw the block diagram of Intel 8259. Also, discuss its operation when all interrupt request lines are high. (06)

3'(b) Explain the control word format of Intel 8254. Also, write the function of read back command and counter latch command. (06)

4(a) For Intel 8086, write a program in assembly language using REP instruction to move a group of bytes from 0202 onwards to 0302 onwards. The count of bytes is stored in 0200 and 0201. Also, write the function of MOVSB and LODSW instruction. (06)

4(b) Discuss the function of Bus Interface Unit and Execution Unit of Intel 8086. (06)

OR

4'(a) Discuss the register organisation of Intel 8086. Explain the function of each register. (06)

4'(b) Explain the following instructions of Intel 8086:
LDS SI, [0200]; RCL AX, CL; CMP SW (06)

Contd......2.
5(a) With the help of an example, explain the following assembler directives:
ASSUME, DD, ENDP, SEGMENT

5(b) For Intel 8086 microprocessor, write a program using assembler directives, to find largest number from a data array.

5(b) OR
Show the input/output signals of Intel 8086 in minimum mode. Also, write the functions of status signals and control signals in minimum mode.