1(a) Compare bipolar and homopolar HVDC transmission link. (04)
1(b) Mention four shortcomings of HVDC transmission system. (02)
1(c) Mention four important components of HVDC converter station. Explain the function of any one of them. (06)
2(a) Define displacement factor. Show that the displacement factor in a six pulse converter = \cos(\alpha), where \alpha is the firing angle. (06)
2(b) Show the variation of currents through valves 1 and 3 in figure 1, during the state when valves 1, 2 and 3 are simultaneously conducting. Justify your answer. (06)

![Figure 1]

3 phase 50 Hz supply

T1 T2 T3 T4 T5 T6

Figure 1

2'(a) Show that TUF for a 6 pulse Graetz circuit is better compared to other configurations. (06)
2'(b) Derive the following waveforms for firing angle \(\alpha = 30^\circ\) and \(\alpha = 15^\circ\) in a six pulse Graetz circuit.
(a) Output voltage
(b) Voltage across valve 1

3 Develop the equivalent circuit for an HVDC transmission system. (12)

OR

3' Develop the converter chart showing the variation of converter nominal average output voltage and current with variation of \(\alpha\), \(\delta\) and \(u\). (12)

4(a) Mention the basic types of FACTS controller. Mention four benefits of using FACTS devices. (06)

4(b) Compare FACTS and HVDC transmission system. (06)

5 With the help of suitable circuit diagram and waveforms explain any two of the following FACTS devices
i) Thyristor Controlled Reactor (TCR)
ii) Thyristor Controlled Switched Capacitor (TCSC)
iii) Static Synchronous Compensator (STATCOM)
iv) Unified power flow controller (UPFC) (12)
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ENERGY MANAGEMENT AND AUTOMATION
EE-434

Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No. Question M.M.
1 Consider an industry facility with 25,000 square ft. of floor space. It uses 3.0
GWh and 7500 GJ of natural gas in one year. The annual cost for
energy is ₹10,150,000 and the annual cost for natural gas is ₹ 1,500,500. Find the
Energy Cost Index (ECI) and Energy Utilization Index (EUI) for this facility. [12]

2 Write short notes on application of SCADA in transmission lines. [12]

OR

2’ Describe the "Security issues in SCADA based Industrial Control Systems". [12]

3(a) Describe the open system interconnection model (OSI) of SCADA. [06]

3(b) Write a detailed note on IEC61850 standard for SCADA. [06]

4(a) Classify and describe in detail the candidate Distribution Automation functions. [06]

OR

4(a’) Describe in detail the control centre architecture for Distribution Automation. [06]

4(b) Write a brief note on automated Network Reconfiguration- and Automated
Mapping and facilities management (AM/FM). [06]

5 Discuss the tariff options for Demand side management (PPT, TOD, TOU). [12]

OR

5 Discuss the implementation issues and load management techniques in DSM. [12]
Q1(a) Define diversity factor and load factor. What are their significance in deciding the cost of generation?

(b) A power station has to supply load as follows:

<table>
<thead>
<tr>
<th>Time in(hours)</th>
<th>0-6</th>
<th>6-12</th>
<th>12-14</th>
<th>14-18</th>
<th>18-24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load(MW)</td>
<td>30</td>
<td>90</td>
<td>60</td>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

i. Draw load duration curve.

ii. Decide suitable generating units to supply the load.

iii. Calculate load factor.

iv. Calculate the capacity and capacity factor of the plant.

OR

(b') Determine the generation cost per unit of energy from the following plant data:

Installed capacity = 150MW

Contd...
Capital cost of the plant = Rs 40,000 per kW
Interest and depreciation = 10%
Fuel consumption = 0.6/ KWh
Fuel cost = Rs 2000 per 1000 Kg
Salaries, wages, repair and other operating costs per annum = Rs 50 * 10^6
Peak load = 120 MW
Load factor = 0.65

Q2(a) What is the objective of tariff? Explain two part tariff system.

OR

(a') What are the causes of poor power factor? Discuss synchronous condenser method to improve it.

(b) A 10 MW thermal power plant has the following data:

Peak load = 8 MW
Plant annual load factor = 0.72
Cost of the plant = Rs 800 per KW installed capacity
Interest, insurance and depreciation = 10% of capital cost
Cost of transmission & distribution system = Rs 350 * 10^3
Interest, depreciation on distribution system = 5%
Operating cost = Rs 350 * 10^3 per year
Cost of coal = Rs 6 per KN
Plant maintenance cost = Rs 30,000 per year (fixed)

= Rs 40,000 per year (running)
Coal used =2,50,000KN/Year

Assume transmission and distribution costs are to be charged to generation, device a two part tariff and cost of generation.

Q3(a) What do you understand by the term co-ordinated operation of power plants? Discuss it's importance.

(b) A steam plant and a hydro plant feed an area jointly. The hydro station is run for 14 hours daily and the steam plant is run for all 24 hours. The production cost characteristics for steam plant is \( C = 8 + 8P_x + 0.05P_x^2 \) Rs/hr. If the load on steam plant, when both plants are in operation is 250 MW the incremental water rate of Hydro plant is \( \frac{dW}{dP_h} = 30 + 0.06P_h \) m³/MWsec. The total quantity of water used during 14 hours is \( 500 \times 10^6 \) cubic meters. Find the load on hydro plant and cost of water used. Assume that load on hydro plant is constant for 14 hour period.

OR

(b') The daily load curve data for a certain area is as under:

<table>
<thead>
<tr>
<th>Time</th>
<th>12-5am</th>
<th>5-8am</th>
<th>8-12 noon</th>
<th>12-1 pm</th>
<th>1-5 pm</th>
<th>5-9pm</th>
<th>9-12 night</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load(MW)</td>
<td>100</td>
<td>150</td>
<td>250</td>
<td>100</td>
<td>250</td>
<td>350</td>
<td>150</td>
</tr>
</tbody>
</table>

It is proposed to install a run-off river plant and a steam plant for supplying above load. The run-off data indicate that a flow of 55m³/sec is available for 97% of the time during the year. The head is 95m, hydro plant efficiency 90% and transmission losses 8%. Determine the capacity of the hydro and steam plants.

... Contd....4.
Q4(a) What is a bus-bar? Discuss duplicate bus bar scheme. What are the other arrangement for it?

(b) With the help of a neat and clean diagram explain the construction and working of brushless excitation system used on an alternator.

OR

(b') Why is governing of hydro turbine necessary? With the help of neat diagram explain the construction and working of a governor used on impulse turbine.

Q5(a) Define touch and Step potentials and their significance. Also deduce expressions for them.

(b) Discuss PLCC system used in power stations.

OR

(b') Draw a single line layout diagram of an EHV sub station and write the function and location of following equipments:

Lightening arrestor, line trap, circuit breaker.
2017-18
B.TECH. AUTUMN (VII SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
CONTROL SYSTEMS
EE-442N

Maximum Marks: 60 Credits: 04 Duration: Two Hours

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

Q.No. Question M.M.
1(a) Explain the difference between a zero order hold and a first order hold. [02]
1(b) Z transform is not a completely reversible process. Why? [02]
1(c) The closed loop transfer function of system is given as [08]

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

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

OR

1'(c) Examine the stability of the following characteristic equation using Jury’s stability criterion. [08]

\[ D(z) = z^3 + 1.3z^2 - 0.08z + 0.24 \]

2(a) Define and explain the following:
   i) Stabilizability  ii) Observer [04]

2(b) Develop a state model for the system shown in Fig.1. Where \( x_1, x_2 \) and \( x_3 \) constitute the state vector. From the developed state model, check stability, controllability and observability of the system. [08]

OR

2'(b) Consider the system [08]

\[ X(t) = \begin{bmatrix} 1 & e^{-t} \\ 0 & -1 \end{bmatrix} x(t) \]

\[ Y(t) = \begin{bmatrix} 1 & 1 \end{bmatrix} x(t) \]

Is this system observable at \( t = 0 \)? If yes, find \( x(0) \) when \( y(t) = e^t \)

3(a) Define and explain the following:
   i) Incidental non-linearity  ii) Limit Cycle [04]

3(b) Discuss the significance of Describing Function in the analysis of non-linear [08]

Contd... 2.
systems. Also explain the conditions under which Describing Function analysis is valid.

3’(b) Derive the Describing function of a relay with dead zone. With the help of suitable examples, explain the stability analysis of non-linear systems using describing function.

4(a) Define and explain the following:
   (i) Local stability (ii) Phase portrait

4(b) For the system shown in Fig. 2, determine the nature of singular points and check the system stability.

OR

4’(b) Draw the phase trajectory for the system described by its dynamic equation as

\[ \dot{y} + 0.6y + 1 = 0 \]

5(a) Define and explain the following:
   i) Admissible control   ii) Principle of optimality   iii) Fuzzy logic

5(b) Explain the working of Model Reference Adaptive Control.
Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

Q. No.  

1(a) Describe the following instructions. Also identify the machine cycles and the addressing modes.  
   i) IN 08 H  
   ii) LHLD 2050 H  
   iii) LXI H, 2050 H  
   iv) LDA 3000 H  

1(b) Illustrate the steps and draw the timing diagram including the status of the lines \( \overline{I} \), \( \overline{RD} \), \( S_0 \), \( S_1 \) when the instruction MOV C, A written at memory location 2005 H is executed. Opcode of MOV C, A is 4F H.  

2(a) Write the initialisation instructions ICW1 and ICW2 for 8259A interrupt controller assuming that the interrupts are to be vectored starting from the memory location 2080 H. Single 8259 A chip is to be used, ICW4 is not needed, interrupts are level triggered and an interval of 4 locations is needed between the interrupt vector locations.  

2(b) Specify the number of times the following loops are executed:  
   i) LOOP: MVIB 64 H  
   ii) ORA A  
   iii) MVI A, 17 H  

   NOP  
   MVI B, 64 H  
   LOOP: ORA A  
   DCR B  
   LOOP: DCR B  
   RRC  
   JNZ LOOP  
   JNC LOOP  

   OR  

2(b') Write a program along with a subroutine for delay to ON/OFF three traffic lights (GREEN, YELLOW, RED) and two pedestrian signs WALK and DON'T WALK. Choose suitable ON time for the various lights. Assume that the pedestrian and the traffic flow are in the same direction.  

3(a) Write the control word format for 8254 programmable interval timer. Write a subroutine to initialise counter 0 in Mode 6 with a count of 40, 000\( \mu \)sec. The subroutine should include reading counts on the fly; when the counter reaches zero, it should return to the main program. Assume that the port addresses for control register and counter 0 are 83H and 82H respectively.  

OR  

3(a') Discuss the various modes of 8255 programmable peripheral interface. Write the initialisation command word to select Mode 0, to configure port A and port C\( _i \) as output ports and port B and port C\( _l \) as an input ports.
3(b) A programmable bidirectional buffer is shown in Fig. 1. Write instructions to initialise the chip as:
   i) an input buffer
   ii) output buffer

4(a) Draw a suitable diagram to show the architecture of 8086 Microprocessor and briefly describe the function of each unit. How is the 20-bit physical address generated in 8086 Microprocessor using 16-bit registers?

4(b) Describe clearly the function of the following instructions:
   i) AAD
   ii) CALL WORD PTR [BX]
   iii) CMP CX, TEMP_MAX
   iv) LEA CX, [BX][DI]
   v) POPF
   v) STOS TARGET_STRING

OR

4(b') i) What is the difference between the minimum and maximum modes of 8086 Microprocessor? How are these modes selected in 8086 Microprocessor?

ii) Construct the machine codes for the following instructions in 8086 Microprocessor:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Opcode</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) MOV 70H[SI], DH</td>
<td>100010</td>
</tr>
<tr>
<td>ii) IN AL, 80H</td>
<td>1110010</td>
</tr>
<tr>
<td>iii) ADD AX, 3800H</td>
<td>0000010</td>
</tr>
</tbody>
</table>

5(a) What are Assembler Directives? Describe the functions of any five Assembler Directives with an example:
   i) ASSUME
   ii) DD
   iii) EXTRN
   iv) OFFSET
   v) ORG
   vi) PTR

5(b) In controlling a chemical process, the temperature of the solution should be up to 100°C. Write a program to turns off heater if temperature ≥ 100°C and turns heater on if temperature < 100°C.

OR

5(b') i) Describe the following briefly:
   i) Editor
   ii) Assembler
   iii) Linker
   iv) Locator

ii) Discuss various types of Microprocessor 8086 interrupts. Describe the series of actions followed by Microprocessor 8086 in response to the interrupt request.