Maximun Marks: 60
Credits: 04
Duration: Two Hour

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

<table>
<thead>
<tr>
<th>Q. No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
</table>
| 1(a)   | Discuss the important features of the following components in HVDC system:  
       i) Converter  
       ii) Coupling Transformer  
       iii) Transmission Line  
       iv) AC filter | [08] |
| 1(b)   | Draw various schemes of DC links in HVDC System. | [04] |
| 2(a)   | What is commutation voltage? Find the commutation voltages of all the valves in a Graetz circuit. | [06] |
| 2(b')  | What are the desired features of a converter? Draw a 3-phase converter circuit with the following configurations:  
       i) q=3, s=2, r=1  
       ii) q=3, s=1, r=2  
       Where q is commutation group, r is number of parallel valves and s is the number of series valves. | [06] |
| OR     | For a converter having q commutation group, s number of series valve and r number of parallel valves, derive a general expression of:  
       i) Derive general expression of DC output voltage for a given firing angle α  
       ii) Derive general expression of Transformer utilization factor | [06] |
| 3      | For a 3 phase full bridge converter in HVDC system having firing angle α = 30°, and overlap angle u= 15°, draw the waveforms of the following:  
       i) Switching sequence  
       ii) Output Voltage  
       iii) Valves current  
       iv) Inverse voltage waveform of a valve | [12] |
| OR     | i) Derive the expression for the DC output voltage of 3 phase full bridge converter having firing angle α and overlap angle u. | [12] |
ii) Show that for low output dc voltage, the 3 phase full bridge converter requires high reactive power.

4(a) Derive the expression for midpoint voltage of a symmetrical lossless line represented by distributed parameters. How mid-point method of VAR compensation with static shunt controller improves midpoint voltage profile? [06]

4(b) Discuss the effect of different type of line compensation on a simple lossless transmission line for reactive power control with the help of appropriate circuit and phasor diagrams. [06]

OR

4(b') Classify different types of transmission line compensator. Briefly explain each giving suitable examples. [06]

5(a) Draw various configurations of SVC as used in transmission lines. Discuss and describe the operating principle of TCR. [06]

5(b) With the help of appropriate circuit diagrams, explain various components and basic principle of operation of a TCSC module. [06]

OR

5(b') Enumerate different modes of operation in a TCSC and describe each using suitable circuit models. [06]
2017-18  
B.E. (AUTUMN SEMESTER) EXAMINATION  
ELECTRICAL  
POEWR STATION PRACTICE  
EEE-435

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.  
1(a) Explain the concept of depreciation. Describe straight line method and sinking fund method to calculate depreciation.  
M.M. [06]

1(b) A steam station has two 110 MW units. The cost data is as under:

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC₁ = Rs 20,000 per kW</td>
<td>UC₂ = Rs 28,000 per kW</td>
</tr>
<tr>
<td>FCR₁ = 10 percent</td>
<td>FCR₂ = 10 percent</td>
</tr>
<tr>
<td>CF₁ = 0.50</td>
<td>CF₂ = 0.65</td>
</tr>
<tr>
<td>Fuel consumption = 0.75 kg/kWh</td>
<td>Fuel consumption = 0.70 kg/kWh</td>
</tr>
<tr>
<td>Fuel cost = Rs 1.6 per kg</td>
<td>Fuel cost = Rs 1.6 per kg</td>
</tr>
<tr>
<td>OM₁ = 20 percent of annual fuel cost</td>
<td>OM₂ = 16 percent of annual fuel cost</td>
</tr>
<tr>
<td>Utilization factor = 1</td>
<td>Utilization factor = 1</td>
</tr>
</tbody>
</table>

Calculate generation cost of unit 1 and unit 2.

where:
UC₁, UC₂: unit capital cost of unit 1 and 2 respectively.  
FCR₁, FCR₂: fixed charge rate for unit 1 and unit 2 respectively.  
CF₁, CF₂: capacity factor for unit 1 and unit 2 respectively.  
OM₁, OM₂: operation, maintenance and labour cost for unit 1 and unit 2 respectively.

OR

1'(a) What is load forecasting? Explain short term load forecasting.  
M.M. [06]

1'(b) The electricity demand pattern of a group of two consumers on a typical winter day is given as under:

<table>
<thead>
<tr>
<th>Consumer A: Connected load</th>
<th>3 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load from 12 midnight to 5 am</td>
<td>150 W</td>
</tr>
<tr>
<td>Load from 5 am to 6 am</td>
<td>1.2 kW</td>
</tr>
<tr>
<td>Load from 6 am to 8 am</td>
<td>200 W</td>
</tr>
<tr>
<td>Load from 8 am to 5 pm</td>
<td>Nil</td>
</tr>
<tr>
<td>Load from 5 pm to 12 midnight</td>
<td>550 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer B: Connected load</th>
<th>3.5 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load from 11 pm to 7 am</td>
<td>Nil</td>
</tr>
<tr>
<td>Load from 7 am to 8 am</td>
<td>350 W</td>
</tr>
<tr>
<td>Load from 8 am to 10 am</td>
<td>1.5 kW</td>
</tr>
<tr>
<td>Load from 10 am to 6 pm</td>
<td>300 W</td>
</tr>
<tr>
<td>Load from 6 pm to 11 pm</td>
<td>650 W</td>
</tr>
</tbody>
</table>

(a) calculate demand factor of both consumers (b) find group diversity factor (c) find energy consumed by each consumer in 24 hours.

Contd. ... 2.
2(a) Define power factor. Show, with the help of phasor diagram, how the power factor of a load can be improved by connecting a capacitor in parallel with it.

2(b) An industrial consumer has an annual energy consumption of 201500 kWh at a load factor of 0.35. The tariff is Rs. 4000 + Rs. 1200 per kW of maximum demand + Rs. 2.20 per kWh. (a) Find his annual bill (b) What is the bill, if the total energy consumption is same but load factor improved to 0.55.

3 Explain the combined operation of reservoir hydro-plant and thermal plant with different rule curves. Also explain short term hydro-thermal coordination.

OR

3′ Enumerate the economic advantages of coordinated operation of different types of power plant. The daily load curve data for a certain area is as under:

<table>
<thead>
<tr>
<th>Time</th>
<th>12-5 am</th>
<th>5-8 am</th>
<th>8-12 noon</th>
<th>12-1 pm</th>
<th>1-5 pm</th>
<th>5-9 pm</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 the above load. The run-off data indicates that a flow of 50m³/sec is available for 97% of the time during the year. The head is 100m and the hydro plant efficiency is 90% and transmission losses 8%. Determine the capacity of hydro plant and steam plant.

4(a) With the help of diagram explain the working of static excitation system used for alternators.

OR

4(a′) What is AVR? With the help of diagram explain rotating amplifier regulator.

4(b) What is bus bar? Explain the ring type of bus bar arrangement and its advantages.

5(a) Explain the following substation equipments and their function:
1. Lightening arrester
2. Isolator
3. Substation earthing system

5(b) What is GIS Substation and how it operates? Where these type of substations are installed?
IV YEAR B.E. EXAMINATION (ELECTRICAL ENGINEERING) 2017-18
CONTROL SYSTEMS (EEE-442N)

Maximum Marks: 60
Duration: 02 Hours

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

1(a) Compare the merits and demerits of state model approach over transfer function based approach.

1(b) Obtain the time response of the following system:
\[
\begin{bmatrix}
\dot{x}_1 \\
\dot{x}_2
\end{bmatrix} = \begin{bmatrix}
-1 & 1 \\
0 & -2
\end{bmatrix} \begin{bmatrix}
x_1 \\
x_2
\end{bmatrix} + \begin{bmatrix}
0 \\
1
\end{bmatrix} u,
\]
\[
y = \begin{bmatrix}
1 & 0
\end{bmatrix} x
\]
Where \( u(t) \) is a unit step input and the initial condition \( x(0) = [-1 0]' \)

OR

1'(a) The state equation of the system are expressed as:
\[
\begin{bmatrix}
\dot{x}_1 \\
\dot{x}_2
\end{bmatrix} = \begin{bmatrix}
-2 & -2 \\
0 & -4
\end{bmatrix} \begin{bmatrix}
x_1 \\
x_2
\end{bmatrix} + \begin{bmatrix}
1 \\
1
\end{bmatrix} u,
\]
\[
y = \begin{bmatrix}
1 & 0
\end{bmatrix} \begin{bmatrix}
x_1 \\
x_2
\end{bmatrix}
\]
Determine the state controllability and observability of the system.

1'(b) Consider a single input-single output control system having an overall transfer function \( T(s) \) given by:
\[
T(s) = \frac{s^2 + 4s + 4}{s^2 + 5s^2 + 4s}
\]
Represent the system in terms of the canonical variables.

2(a) State and explain the sampling theorem.

2(b) Determine the pulse transfer function of the system shown below:

\[\text{Block Diagram}\]

3(a) Develop the relationship between s and z planes.

3(b) Using Jury’s method, determine the stability of a discrete data system whose characteristic equation is given by:
\[
z^2 - 1.8z^2 + 1.05z - 0.2 = 0.
\]

OR

3'(a) The state model of a discrete time system is given as:
\[
\begin{bmatrix}
x_1(k+1) \\
x_2(k+1)
\end{bmatrix} = \begin{bmatrix}
-2 & 1 \\
1 & -3
\end{bmatrix} \begin{bmatrix}
x_1(k) \\
x_2(k)
\end{bmatrix} + \begin{bmatrix}
1 \\
2
\end{bmatrix} u(k),
\]
\[
y(k) = \begin{bmatrix}
-1 & 1
\end{bmatrix} \begin{bmatrix}
x_1(k) \\
x_2(k)
\end{bmatrix}
\]
Find \( y(0), y(1), y(2) \) and \( y(3) \) if \( u(k)=1 \) and zero initial conditions.

contd...
4(a) The difference equations for a discrete data system are given as:
\[ x_1(k+1) = -0.5x_1(k) + 0.25x_2(k) + u(k) \]
\[ x_2(k+1) = 0.25x_1(k) - 0.75x_2(k) + 2u(k) \]
i) Develop a state model for this system and show that the poles of the system can be placed arbitrarily.
ii) Determine state feedback matrix to transfer the system poles to the origin.

4(b) The second order system is specified as:
\[
\begin{bmatrix}
x_1' \\
x_2'
\end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u,
\]
\[ y = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \]
Find a suitable state feedback gain matrix using Ackerman's formula so as to place both the closed loop poles at \( s = -1 \).

5(a) Determine the sign definiteness of the following quadratic function:
\[ Q = 10x_1^2 + 4x_2^2 + x_3^2 + 2x_1x_2 - 2x_2x_3 - 4x_1x_3. \]

5(b) The dynamics of a system given by:
\[
\begin{bmatrix}
x' \\
x
\end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & -1 & 1 \\ -k & 0 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}
\]
If \( V(x) = 5kx_1^2 + 2kx_1x_2 + 20x_2^2 + 8x_2x_3 + x_3^2 \).
Show that: \( \frac{dV}{dt} = -(40-2k)x_2^2 \). Also, determine the range of \( k \) for which the system is stable.

OR

5'(a) Define the following terms:
i) Node  ii) Center  iii) Saddle

5'(b) Construct a phase portrait of a system represented by following differential equations:
\[ X' = 4X - 3Y \]
\[ Y' = 6X - 7Y \]
2017-2018
B. E. (AUTUMN SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
MICROPROCESSOR SYSTEMS AND APPLICATIONS
(EEE-473)
Maximum Marks: 60
Credits: 04
Duration: Two Hours

NOTE: i) Answer any TWO parts from each question.
    ii) Every part carries equal marks.

1. (a) Write the function of the following pins of 8085 microprocessor:
    (i) HOLD  (ii) READY  (iii) RESETOUT  (iv) X1 & X2  (v) SID
    6
(b) Explain the functions of the following instructions of 8085 microprocessor:
    (i) DAA  (ii) RAR  (iii) RET
    6
(c) What do you understand by Tri-state Buffer? Why are they essential in 8085
    based systems?
    6

2. (a) Write instructions to enable interrupt RST 5.5 and mask other interrupts.
    6
(b) Explain 8259 initialization when ICW1=76.
    6
(c) Explain the sequence of events when 8257 DMA Controller performs a DMA
    data transfer.
    6

3 (a) Describe the following modes of operations of 8254
    (i) Rate Generator Clock
    (ii) Software Triggered Strobe
    6
(b) Explain the working of different ports when 8255 PPI is set in Mode 2.
    6
(c) Draw the block diagram of a Typical Successive-Approximation A/D Converter
    as an Integrated Circuit.
    6

4. (a) List salient features of 8086 microprocessor.
    6
(b) Explain the functions of the following registers of 8086 Microprocessor:
    (i) Segment Registers  (ii) Index Register  (iii) Instruction Pointer
    6
(c) Explain the following addressing modes of 8086 microprocessor:
    (i) Based-Indexed Addressing Mode
    (ii) Intra Segment Indirect Addressing Mode
    (iii) Inter Segment Indirect Addressing Mode
    6

5. (a) List the software interrupts in 8086 microprocessor and explain their functions in
    brief.
    6
(b) Define MACROS with suitable example.
    6
(c) In how many groups the instruction set of 8086 microprocessor divided? Give at
    least one example of each.
    6