2016-17
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
POWER ELECTRONICS-II
EEE-322N

Maximum Marks: 60  Credits: 04  Duration: Two Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Questions</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Draw the IV characteristics of a power MOSFET explaining various regions of operation. Draw and explain the safe operating area of a power MOSFET. Compare the features of power IGBT, MOSFET and BJT.</td>
<td>(12)</td>
</tr>
<tr>
<td>2(a)</td>
<td>With suitable waveforms and circuit diagram explain the operation of a buck boost converter. Obtain the relationship between average input and output voltage. Also obtain the expression for ripple current in inductor.</td>
<td>(8)</td>
</tr>
<tr>
<td>2(b)</td>
<td>A flyback converter of has the following circuit parameters: $V_s = 24, \text{V}$, $N1/N2 = 3.0$, $L_m = 500, \mu\text{H}$, $R = 5, \Omega$, $C = 200, \mu\text{F}$, $f = 40, \text{kHz}$, $V_o = 5, \text{V}$ Determine (a) the required duty ratio $D$; (b) the average, maximum, and minimum values for the current in $L_m$; and (c) the output voltage ripple. Assume that all components are ideal.</td>
<td>(4)</td>
</tr>
<tr>
<td>3</td>
<td>With suitable waveforms of gating signals and output voltage discuss the integral cycle control for single-phase a.c. voltage regulator. Derive the expression for r.m.s value of the output voltage.</td>
<td>(12)</td>
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</tbody>
</table>

**OR**

| 3'    | Taking $\alpha = 30^\circ$, draw (on Fig. 1.) and explain the formation of output phase-voltage ($v_{om}$) for a three-phase voltage controller with the consideration that a balanced star connected supply is connected to a star connected R-load. | (12) |
| 4(a)  | With the help of circuit diagram and waveform explain the operation of a class C type commutation circuit.                                                                                                                     | (6)  |
| 4(b)  | With the help of a circuit diagram and suitable waveform explain the operation of a single phase bridge inverter feeding an RL load.                                                                                   | (6)  |

**OR**

| 4(b') | Obtain the THD of the output voltage of a square wave inverter.                                                                                                                               | (6)  |
OR

4' With the help of circuit diagram and waveform explain the modes of operation of a modified McL Murray inverter.

5 Draw a neat sketch of a three-phase VSI that employs IGBTs and is connected to a three-phase balanced R-load. Sketch its pole voltages, line-line voltages and phase-voltages clearly describing the magnitudes of each level for 180° conduction mode.

(Tear and attach it in your answer book (for Q. 3'))

(Fig. 1.)
2016-17
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
NEW AND RENEWABLE ENERGY SOURCES
EEE-325

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  What do you understand by energy resources? Give classification of resources of energy. Discuss each of them in detail.  [12]

2(a)  With the help of schematic diagram explain the working of distributed collector solar thermal electric power plant.  [06]

2(b)  A PV source having IV characteristic as shown in the figure given below, is supplying power to a load whose load line intersects the characteristic at (10V, 8A). Determine the additional power gained if an MPPT is interposed between the source and the load. If the cost of the MPPT is Rs. 4000.00, for how long does the system need to operate in order to recover the cost of MPPT? The cost of electricity may be assumed as Rs 5.00 per kWh. Consider efficiency of MPPT to be 95%.

[Diagram of PV system - load characteristics]

OR

2'(a)  What is the importance of MPPT in a solar PV system? Explain any two strategies used for operation of an MPPT.  [06]

2'(b)  Calculate the angle of incidence of beam radiation on a plane surface tilted by 45° from the horizontal plane and pointing 30° west of south located at Mumbai at 1:30 P.M. (IST) on 15th November. The longitude and latitude of Mumbai are 72° 49' E and 18° 54' N respectively. The standard longitude for IST is 81° 44' E.
3(a) Enlist different conversion technologies for extracting energy from biomass. Discuss in detail the general outlines of two biochemical processes.

3(b) Find the size of a cow dung based biogas plant required for a house having the following requirements:
   a) Cooking for two adults and two children
   b) Lighting for three hours daily, using three gas mantle lamps, each of 100 CP (candle power)

Also calculate number of cows required to feed the plant.

Biogas required for cooking is about \(0.227 \text{ m}^3/\text{person/day}\). Gas required for lightning a 100 CP (candle power) mantle lamp is \(0.126 \text{ m}^3/\text{hour}\).

(Note: Two children may be considered as equivalent to one adult for cooking energy purpose.)

4(a) What are the main features of vertical axis wind turbine (VAWT)? Sketch the diagram and explain the functions of main components of VAWT.

4(b) A propeller type wind turbine has the following data:
   Speed of wind = 12m/s upstream
   Air density = 1.226 kg/m³
   Wind velocity at turbine reduced by 15%
   Generator efficiency = 85%

find:
   i. Total power available in wind
   ii. Power extracted by turbine
   iii. Electrical power generated
   iv. Power coefficient

OR

4'(a) Explain fixed speed drive schemes used in wind energy conversion system.

4'(b) Using Betz model of a wind turbine derive the expression for power extracted from wind. What is the maximum theoretical power that can be extracted and under what condition?

5(a) A single basin type tidal power plant has basin area of 3 km². The tide has an average range of 10 m. Power is generated during flood cycle only. The turbine stops operating when the head on it falls below 3 m. Calculate the average power generated by the plant in a single filling process of the basin if the turbine generator efficiency is 0.65. Estimate the average annual energy generation of the plant.

5(b) Name various types of geothermal resources. With neat sketch explain hot dry rock (HDR) resources.

OR

5(b') With the help of neat diagram, explain the principle of operation of an Alkaline fuel cell.
2016-17  
B.E. (WINTER SEMESTER) EXAMINATION  
ELECTRICAL ENGINEERING  
POWER SYSTEM PROTECTION  
EEE-333N  

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours  

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

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<tr>
<td>1(a)</td>
<td>Draw a neat sketch of a wattmetric type induction disc relay and discuss its operating principle.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Classify the various types of overcurrent relays? Explain any four with their area of applications.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(a)</td>
<td>Describe the cross differential protection scheme of an alternator.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Explain the protective scheme used for the protection of double bus-bar.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(a)</td>
<td>What type of protective scheme is employed for the protection of a power transformer against internal short circuits? With a neat sketch, discuss its working principle.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(b)</td>
<td>Explain the carrier current protection scheme used for the protection of transmission lines.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a)</td>
<td>What is meant by arc interruption? Discuss recovery rate theory of arc interruption. Explain the terms (a) arc voltage, (b) re-striking voltage and (c) recovery voltage.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Discuss in brief the phenomenon of current chopping when low inductive current is being interrupted.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b')</td>
<td>A 132 kV, 50 Hz alternator is connected to a circuit breaker. The inductive reactance up to circuit breaker is 4.5 Ω/phase. The distributed capacitance up to circuit breaker between phase and neutral is 0.01 μF. Calculate (a) frequency of re-striking voltage transient, (b) maximum value of re-striking voltage across the</td>
<td>[06]</td>
</tr>
</tbody>
</table>
breaker contacts and (c) maximum value of RRRV.

4(a) Classify various circuit breakers depending upon the arc quenching medium employed. Explain the construction and working of any one type of circuit breaker. [06]

4(b) What are the different tests carried out on a circuit breaker? Differentiate between type tests and routine tests. [06]

5(a) A cable with a surge impedance of 100 Ω is terminated in two parallel-connected open-wire lines having surge impedances of 600 Ω and 1000 Ω respectively. If a steep fronted voltage wave of 1000 V travels along the cable, find the value of transmitted voltage and current in open-wire lines as well as the incident and reflected current in the cable immediately after the travelling wave has reached the transition point. The line may be assumed to be infinite length. [06]

5(b) Enumerate the causes of over voltages in a system. Discuss the construction and principle of operation of metal oxide surge arrestor. [06]

OR

5(b') Differentiate between “hot” and “cold” lightening strokes. Discuss in brief overvoltage protection schemes for transmission lines, stations and substation equipments. [06]
2016-17  
B.E (VI SEMESTER) EXAMINATION  
(ELECTRICAL)  
POWER SYSTEM ANALYSIS  
(EEE-335N)

Maximum Marks: 60  
Duration: Two Hours

Answer all questions.  
Symbols and abbreviations used have their usual meaning.  
Any missing data may suitably be assumed.  
Start writing each answer from a fresh page.

Q.No. Questions M.M

1.  (a) What is the purpose of performing load flow analysis in power system? [05]  
    (b) Draw a per unit reactance diagram for the three phase system shown in fig.1. Choose 20 MVA and 66 KV as base values. [07]

   OR

1’ (a) Enumerate the advantages of $Y_{BUS}$ over $Z_{BUS}$ model. [05]  
    (b) Determine $Y_{BUS}$ for the 3- bus system as shown in fig.2. The line series impedances are as follows:

<table>
<thead>
<tr>
<th>Line (bus to bus)</th>
<th>Impedance (p.u.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>0.06 + j 0.18</td>
</tr>
<tr>
<td>1-3</td>
<td>0.03 + j 0.09</td>
</tr>
<tr>
<td>2-3</td>
<td>0.08 + j 0.24</td>
</tr>
</tbody>
</table>

2.  (a) What is meant by unit commitment? Explain [06]  
    (b) A system consists of two plants connected by transmission line as shown in fig.3. The load is at plant 2. If a load of 125 MW is transmitted from plant 1 to the load, there is a loss of 12.5 MW. Determine the generation schedule and the load demand if the cost of received power is Rs 70 per MWh. Assume that the incremental costs of two plants are given by:

$$\frac{dC_1}{dP_1} = 0.25 P_1 + 40 \text{ Rs/MWh}$$
$$\frac{dC_2}{dP_2} = 0.20 P_2 + 50 \text{ Rs/MWh}$$

Solve the problem using penalty factor method.

3.  (a) What do you understand by positive, negative and zero sequence impedances? [06]  
    (b) A three phase 10 MVA, 11 KV synchronous generator with a solidly grounded neutral point supplies a feeder. The relevant impedances of the generator and feeder are as follows:
To positive sequence currents, $Z_1$  
\[ j1.2 \Omega \]
To negative sequence currents, $Z_2$  
\[ j0.9 \Omega \]
To zero sequence currents, $Z_0$  
\[ j0.4 \Omega \]

If a fault from one phase to earth occurs on the far end of the feeder as shown in fig.4, calculate the magnitude of fault current.

OR

3’
(a) What is the necessity of using current limiting reactors in power system?  
(b) A three phase transmission line operating at 33 KV and having a resistance and reactance of 5 $\Omega$ and 20 $\Omega$ respectively is connected to a generating station busbar through a 15 MVA step-up transformer which has a reactance of 0.06 per unit. Connected to the busbar are two generators, one 10 MVA having 0.10 per unit reactance and another 5 MVA having 0.075 per unit reactance. Calculate the short circuit MVA and the fault current when a three phase short circuit occurs at the high voltage terminals of the transformer as shown in fig.5.

4.  
(a) Discuss equal area criteria for transient stability when the shaft power is suddenly increased.  
(b) Discuss various methods for the improvement of transient stability of a system.

OR

4’
(a) What is meant by infinite bus? Explain.  
(b) A generator is delivering 0.6 of maximum power to an infinite bus through a transmission line. A fault occurs such that the reactance between the generator and the infinite bus is increased to three times its prefault value. When the fault is cleared, the maximum power that can be delivered is 0.8 of the original maximum value. Determine the critical clearing angle.

5.  
(a) Enumerate various types of D.C distributors used in distribution system. What are the advantages of a doubly fed distributor over singly fed distributor?  
(b) A 2-wire D.C distributor AB is 300 m long. It is fed at point A. the various loads and their positions are given below:

<table>
<thead>
<tr>
<th>At point</th>
<th>Distance from A in metres</th>
<th>Concentrated load in Amperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>D</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>E</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>F</td>
<td>250</td>
<td>50</td>
</tr>
</tbody>
</table>

If the maximum permissible voltage drop is not exceeding 10 V, find the cross-sectional area of the distributor. Take $\rho = 1.78 \times 10^{-8} \Omega \cdot m$.
2016-17
B.E. (WINTER SEMESTER) EXAMINATION
ELECTRICAL
DYNAMIC SYSTEM ANALYSIS
EEE-341N

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Root locus is to be drawn on graph paper and Bode plot is to be drawn on semi log graph paper if required.

Q.No. Question M.M.
1(a) Discuss the effect of incorporating feedback in a control system. Also give the derivations, if any. [06]
1(b) What is mechanical-electrical analogy? Also write the different analogous elements in tabulated form. [06]
2(a) Using Mason’s gain formula, find the transfer function of the signal flow graph given in figure-1:

![Figure-1]

2(b) Explain the working of DC servomotor, also mention its applications. [06]

OR

2'(a) Obtain the transfer function between R(s) and U(s) for the block diagram given in figure below:

contd...
2'(b) Discuss the constructional features and working of ac tacho-generator.

3(a) Derive the expression of output response of a second order system with unity feedback subjected to unit step input.

3(b) Discuss the necessary and sufficient conditions for a system to be absolutely stable.

OR

3' Sketch root locus for a unity feedback system with \( G(s) = \frac{k}{s(s+6)(s^2+4s+20)} \)

For what range of values of \( k \) is the system stable?

4 Sketch the Nyquist plot of a unity feedback system whose open loop transfer function is \( G(s) = \frac{100}{s(s+1)(s+2)(s+5)} \)

OR

4' Draw the Bode plot of a unity feedback system whose open loop transfer function is

\[ G(s) = \frac{16(1 + 0.5s)}{s^2(1 + 0.125s)(1 + 0.1s)} \]

From the graph, determine:

1) Phase cross over frequency
2) Gain cross over frequency

5(a) What are compensators? Draw the electrical networks used for phase-lead and phase-lag compensation.

5(b) What are the different members of PID family? Describe the effects of incorporating a PI and PD controller on the response of the system.