**2018-19**
**B. E. (AUTUMN SEMESTER) EXAMINATION**
**ELECTRICAL ENGINEERING**
**CONTROL ENGINEERING**
**EEE-305**

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
</table>
| 1(a)  | Distinguish between:  
   (i) Open loop and closed loop system.  
   (ii) Linear and non-linear system.                                                                                                                                                                     | [06] |
| 1(b)  | Obtain the transfer function of the system shown in figure-1. \( f(t) \) is the input & \( x_2(t) \) is the output.                                                                                           | [06] |
|       | ![Figure-1](image)                                                                                                                                                                                      |      |

**OR**

1(b') With the help of neat sketch explain the working of synchro transmitter.  
2(a) Using block diagram reduction technique find the transfer function of figure-2  

![Figure-2](image)

2(b) Draw the signal flow graph of the block diagram shown in figure-2. Determine the overall transfer function using Mason’s Gain formula.

3 Examine the Controllability & Observability of the system given by

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End of Document
\[
\begin{bmatrix}
x_1' \\
x_2' \\
x_3'
\end{bmatrix} =
\begin{bmatrix}
0 & 1 & 0 \\
0 & 0 & 1 \\
0 & -2 & -3
\end{bmatrix}
\begin{bmatrix}
x_1 \\
x_2 \\
x_3
\end{bmatrix}
+ \begin{bmatrix}
0 \\
0 \\
1
\end{bmatrix} u \quad \text{and} \quad y = \begin{bmatrix} 3 & 4 & 1 \end{bmatrix}
\begin{bmatrix}
x_1 \\
x_2 \\
x_3
\end{bmatrix}
\]

4(a) Determine the stability of a system whose transfer function is given as
\[
\frac{C(s)}{R(s)} = \frac{2s + 5}{s^5 + 1.5s^4 + 2s^3 + 4s^2 + 5s + 10}
\]
If found unstable, how many roots it has with positive real part?

OR

4(a') Derive the impulse response of a first order control system.

4(b) The forward path gain of a unity feedback control system is
\[
G(s) = \frac{44}{s(s + 12)}
\]
Determine maximum overshoot, peak time, rise time, settling time.

OR

4(b') Determine the type and order of a unity feedback system, given the open loop transfer function:
\[
G(s) = \frac{100(s + 5)(s + 50)}{s^4(s + 10)(s^2 + 3s + 10)}
\]

5 Sketch the Nyquist plot for a system with unity feedback, given
\[
G(s) = \frac{10}{(s + 1)(s + 2)(s + 5)}
\]

OR

5'(a) Briefly discuss about proportional, integral & derivative controller. A PID controller is introduced in a unity feedback system with open loop transfer function as
\[
G(s) = \frac{\omega_n^2}{s(s + 2\xi\omega_n)}
\]
Draw the block diagram of complete system.

5'(b) Sketch the Bode Magnitude plot of a unity feedback system with open-loop transfer function given as:
\[
G(s) = \frac{50}{(s + 1)(s + 2)}
\]
Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No. | Question | CO | M.M.
--- | --- | --- | ---
1(a) | With the help of relevant circuit diagram explain the various modes of operation of a Triac. Also draw its I-V characteristics. | (CO1) | [06]
1(b) | Write four advantages of GTO over SCR. Also mention two applications of GTO. | (CO1) | [06]
2(a) | With reference to ac-dc converters explain the following terms: i) input displacement factor ii) input power factor and iii) total harmonic distortion. | (CO1) | [03]
2(b) | For the circuit shown in figure 1 obtain the expression for THD of input current, displacement factor and input power factor. Assume constant load current. | (CO2) | [09]

Figure 1

OR

2'(a) | The fully controlled thyristor converter in the Fig. 1 is fed from a single phase source. When the firing angle is 0°, the dc output voltage of the converter is 300V. What will be the output voltage for a firing angle of 60°, assume continuous conduction. | (CO2) | (06)
2'(b) | The phase controlled converter shown in Fig. 2 is fired at an angle α. If the peak value of the instantaneous output voltage is equal to 230V, determine the...
value of $\alpha$ and the average output voltage.

![Figure 2](image)

3(a) Draw a UJT based firing circuit for a full wave controlled rectifier and explain its working. (CO3) (09)

3(b) What is the function of a driver in a microcontroller based firing circuit? (CO3) (03)

4 Derive the expression for the average output voltage of a three phase full wave bridge type controlled rectifier for the following two cases.
   i. Firing angle is less than $\pi/6$.
   ii. Firing angle is more than $\pi/6$.

OR

4' Draw the waveforms for the output voltage and the input three phase current for the converter shown in Fig. 3. Assume firing angle to be $\pi/3$.

![Figure 3](image)

5 With the help of a circuit diagram and waveforms explain the working of (CO3) (12) (ANY ONE) of the following for RL load. Also find the RMS value of output voltage for a firing angle of $\alpha$.
   a) A single phase cycloconverter (with output voltage frequency $\frac{1}{2}$ of input voltage frequency)
   b) A single phase ac voltage controller

...contd...
2018-19
B.E. (V SEMESTER) EXAMINATION
(ELECTRICAL)
ELECTRICAL POWER GENERATION AND UTILIZATION (EEE-331)

Maximum Marks: 60
Duration: Two Hours

Instructions:
1. Answer all questions.
2. Symbols and abbreviations used have their usual meaning.
3. Any missing data may suitably be assumed.
4. Wherever possible illustrate your answer with appropriate figures
5. Answer each question on a fresh page.

<table>
<thead>
<tr>
<th>Q. No.</th>
<th>Questions</th>
<th>M.M</th>
</tr>
</thead>
</table>
| 1. (a) | Explain the function of the following:  
(i) Steam turbine  
(ii) Condenser  
(iii) Re-heater  
(b) Explain Rankine cycle. Draw the diagram by showing the directions and labeling the components related to the path of steam flow that come under Rankine cycle in thermal power plant. | [6] |

OR

1'. (a) Describe with the help of a neat diagram, the construction and working of a pressurized water reactor (PWR).  
(b) Find the $^235$ fuel used in one year in a 235 MW pressurized water reactor. Assume an overall plant efficiency of 33% and load factor of 100% throughout the year. | [6] |

2. (a) What are pumped storage plants? Describe with a neat sketch the principle of operation of such a plant.  
(b) Write down the essential components of hydro power plants. Discuss in detail about the working of surge tank under different load conditions. | [6] |

OR

2' (a) Draw a neat sketch of layout of closed cycle gas turbine plant and explain its working.  
(b) What do you understand by Integrated Gasification Combined Cycle? Explain its working with suitable diagram. | [6] |
3. (a) What do you understand by cogeneration? Explain any one cogeneration technology with neat sketch.

(b) What is Distributed Power Generation? Write down its advantages.

4. (a) A 200 tonne motor coach having 4 motors, each developing 6000 N-m torque during acceleration, starts from rest. If up-gradient is 30 in 1000, gear ratio 4, gear transmission efficiency 90%, wheel radius 45 cm, train resistance 50 N/tonne, addition of rotational inertia 10%, calculate the time taken to attain speed of 50 Km/h.

(b) Give necessary sketches and explain briefly the different methods of current collectors used in electric traction.

5. (a) With the help of suitable diagram and chemical reactions, discuss the working of Lead-Acid battery when positive terminal of supply is connected to anode and negative terminal to cathode.

(b) It is required to provide an illumination of 100 lux in a factory hall 30 m x 12 m. The lamps are required to be hung 3 m above the work bench. Assume that the maintenance factor is 0.8, the coefficient of utilization is 0.4 and the efficiency of proposed lamps is 11 lumens per watt. Calculate the number, power rating and their disposition.

OR

5'. (a) What is current efficiency? A copper refining plant, employing 400 electrolytic cells, carries current of 6000 amperes, voltage per cell being 0.25 volts. If plant is working for 45 hours/week, determine the energy consumption per metric ton, assuming E.C.E of copper as 0.3281 mg/coulomb of electricity.

(b) With the help of suitable diagram, explain the construction and working of sodium vapour lamp.

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

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>CO</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Explain RAMP type DVM with the help of timing and block diagram.</td>
<td>(CO1)</td>
<td>[05]</td>
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<tr>
<td>OR</td>
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<tr>
<td>1(a')</td>
<td>Describe the digital measurement of time, mentioning the role of important blocks.</td>
<td>(CO1)</td>
<td>[05]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Use a block diagram to explain the operation of sample &amp; hold circuit.</td>
<td>(CO1)</td>
<td>[03]</td>
</tr>
</tbody>
</table>
| 1(c)  | a) Main component of an integrating type DVM is _______  
      b) What is the effect of clock on the voltage in DVM?  
      c) The resolution of a 3 digit display on 1 V range is _______  
      d) Consider a 3 digit display for a DVM with an accuracy of ± 0.5 % for a reading of ± 1 digit. Find the error for 5 V reading on a 10 V range. | (CO1) | [04] |
| 2(a)  | Compare between Pneumatic and Electrical Telemetry System, highlighting the areas of application and limitations in each case. | (CO2) | [06] |
| 2(b)  | Explain various types of pulse modulation, mentioning their areas of application. | (CO2) | [06] |
| OR    |          |      |      |
| 2(a') | Explain the modern Digital Data Acquisition system, mentioning the role of important blocks. | (CO2) | [06] |
2(b) Synchronous TDM has been used to combine 18 digital sources, 6 each of 100 Kbps, 6 each of 200 Kbps, 6 each of 300 Kbps. Each output slot carries 3 bit from each digital source, but two extra bits are added to each frame for synchronization. Answer the following questions:
   a) What is the size of an output frame in bits?
   b) What is the output frame rate?
   c) What is the duration of an output frame?
   d) What is the output data rate?
   e) What is the efficiency of the system?
   f) Which data management technique has been used in this case?

3(a) A Hall Effect transducer is used under the magnetic field of 0.5 Wb/m². The 2 mm thick slab is made of Bismuth for which the hall coefficient is \(-1 \times 10^{-6}\) Vm and the current is 3 A, find the hall voltage.

3(b) Describe temperature measurement transducers along with their general equations and limitations.

<table>
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<th>OR</th>
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</table>

3(b') Explain two electrical and one mechanical methods to measure liquid level.

4(a) Explain differential capacitive transducer and obtain the expression for its sensitivity.

4(b) What are optical encoders and electrical encoders? How a gray code eliminates ambiguity error in reading optical encoder?

5 Describe briefly about (ANY TWO) of the following
   a) NANO Instrumentation
   b) Robotics Instrumentation.
   c) Smart Sensors
   d) Global Positioning System.

(CO2) [06]  
(CO2) [86]  
(CO3) [06]  
(CO3) [06]  
(CO3) [06]  
(CO4) [12]
**2018-19**  
**B.E. (AUTUMN SEMESTER) EXAMINATION**  
**ELECTRICAL ENGINEERING**  
**HIGH VOLTAGE ENGINEERING**  
**EEE-361**

Maximum Marks: 60  
Credits: 04  
Duration: Two Hours

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

<table>
<thead>
<tr>
<th>Q.No.</th>
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</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>Derive the Townsend’s current growth equation. Also derive the Townsend’s criterion for breakdown.</td>
</tr>
<tr>
<td>1(b)</td>
<td>Differentiate between suspended particle theory and cavitation and bubble theory of breakdown of liquid dielectrics.</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
</tr>
<tr>
<td>1(a’)</td>
<td>Enumerate various mechanisms that lead to breakdown in solid dielectrics. Explain electromechanical breakdown and breakdown due to treeing and tracking in detail.</td>
</tr>
<tr>
<td>1(b’)</td>
<td>What do you mean by the electron attachment process in gases?</td>
</tr>
<tr>
<td>2(a)</td>
<td>Draw the four equivalent circuits for producing impulse waves. Derive the equation for the output voltage for any one of the circuits to show that it is a double exponential wave.</td>
</tr>
<tr>
<td>2(b)</td>
<td>What is a switching surge? What are the various methods used for generating switching surges.</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
</tr>
<tr>
<td>2(b’)</td>
<td>Draw and explain the Cockcroft-Walton voltage multiplier circuit.</td>
</tr>
</tbody>
</table>
3(a)  With the help of a neat diagram explain the Chubb-Fortescue method for high voltage measurements. Also explain how the influence of frequency on the measurement is eliminated.

OR

3(a')  Explain in detail the working principle and construction of electrostatic voltmeter.

3(b)  What are the various factors influencing the sparkover voltage of a sphere gap.

4(a)  Derive the expression of the loss tangent for series and parallel R-C equivalent circuits of dielectrics. Also derive the expression for the same using the concept of complex permittivity.

4(b)  Discuss the loss of charge method for measuring the DC resistivity of solid dielectrics.

5(a)  What are the various tests performed for testing the bushings of high voltage machines?

5(b)  Define the following terms:
   i.  Disruptive discharge voltage.
   ii. Fifty percent flashover voltage.
   iii. Creepage distance.
1(a) An overseas company is planning to install a captive power plant. The company expects that the maintenance cost of the power plant will be $3,00,000 per year after the captive power plant is put to service. Beginning 3 years from now, however, the maintenance cost is likely to increase by 5% per year into a foreseeable future. The estimated cost of commissioning the plant, as of now is $4,00,00,000. Once the power plant is put to service, the company will not only save on its own consumed power but sales of excess available power would bring $18,00,000 worth of revenue per year. If the company uses a 7 year study period and an interest rate of 12% per year, determine whether the company should go for the captive power plant? If no, calculate how much additional revenue per year must be generated to justify the investment in this captive power plant.

1(b) What are the different type of market segments? Explain the phenomenon of inflation and explain it with the help of supply-demand curve.

OR

1'(a) A company is evaluating two alternatives for modernization of its facility. The capital investment data for the two alternatives is given in the following table. Evaluate and recommend the best alternative. Use MARR of 12% per year.

<table>
<thead>
<tr>
<th></th>
<th>Alternative 1</th>
<th>Alternative 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Investment (in $)</td>
<td>700000</td>
<td>1100000</td>
</tr>
<tr>
<td>Annual Expenses (in $)</td>
<td>150000</td>
<td>295000</td>
</tr>
<tr>
<td>Annual Revenues (in $)</td>
<td>450000</td>
<td>750000</td>
</tr>
<tr>
<td>Salvage Value (in $)</td>
<td>150000</td>
<td>50000</td>
</tr>
<tr>
<td>Useful Life</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

1'(b) What are Economic Indicators? Explain. Differentiate between GDP and GNP.
A grinder was purchased 3 years ago for $40,000. It has provided adequate service, but an improved version is now available for $35,000 that will reduce operating costs and cut inspection expenses. Costs and salvage values for the two machines are shown below. Costs that are the same for either machine are not included. Also, the operating costs for the challenger are very low due to warranted equipment. Should a replacement be made if the required rate of return is 15% and the service of the grinder will be needed for only 4 more years? If yes, when?

<table>
<thead>
<tr>
<th>Year</th>
<th>Defender D</th>
<th></th>
<th>Challenger C</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Cost ($)</td>
<td>Salvage Value ($)</td>
<td>Operating Cost ($)</td>
<td>Salvage Value ($)</td>
</tr>
<tr>
<td>0</td>
<td>-</td>
<td>12000</td>
<td>-</td>
<td>35000</td>
</tr>
<tr>
<td>1</td>
<td>3400</td>
<td>7000</td>
<td>200</td>
<td>30000</td>
</tr>
<tr>
<td>2</td>
<td>3900</td>
<td>4000</td>
<td>1000</td>
<td>27000</td>
</tr>
<tr>
<td>3</td>
<td>4600</td>
<td>2500</td>
<td>1200</td>
<td>24000</td>
</tr>
<tr>
<td>4</td>
<td>5600</td>
<td>1000</td>
<td>1500</td>
<td>20000</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>2000</td>
<td>17000</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>2600</td>
<td>15000</td>
</tr>
</tbody>
</table>

3(a) Define management. Explain the major functions of management.

3(b) Compare and contrast the three decision making environments.

4(a) Describe the organizational plans in terms of being (i) strategic or operational, (ii) short term or long term, and (ii) specific or directional.

4(b) What do you understand by the term ‘departmentalization’? List and briefly explain the five common forms of departmentalization that are used in organizations.

OR

4’ Explain the content perspective of motivation as defined by Maslow’s Hierarchy of Needs. What are its limitations?

5 A company sells and delivers office supplies to offices, schools, and agencies within a 50-mile radius of its warehouse. The office supply business is competitive, and the ability to deliver orders promptly is a big factor in getting new customers and maintaining old ones. The manager of the company wants to be certain that enough drivers and vehicles are available to deliver orders promptly and that they have adequate inventory in stock. Therefore, the manager wants to be able to forecast the demand for deliveries during the next month. From the records of previous orders, management has accumulated the following data for the past 10 months:

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders</td>
<td>120</td>
<td>90</td>
<td>100</td>
<td>75</td>
<td>110</td>
<td>50</td>
<td>75</td>
<td>130</td>
<td>110</td>
<td>90</td>
</tr>
</tbody>
</table>

Compute the monthly demand forecast for April through November using a 3-month moving average.