1(a) With the help of relevant equations and circuit diagram explain the two transistor model of an SCR. (06)

(b) Define the following terms.
   i) Holding Current of SCR
   ii) dv/dt rating of SCR
   iii) Reverse recovery current of power diode

2(a) With reference to ac-dc converters explain the terms:
   i) input displacement factor
   ii) input power factor
   iii) total harmonic distortion. (03)

(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. (09)

![Figure 1](image)

2'(a) The fully controlled thyristor converter in the figure 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. (06)

(b) The phase controlled converter shown in figure 2 is fired at an angle α. If the peak value of the instantaneous output voltage is equal to 230V, determine the value of α and the average output voltage. (06)
3(a). Draw a full wave RC type firing circuit for an SCR and explain its working. (09)

3(b). What is the function of a pulse transformer in a firing circuit? (03)

4. Derive the expression for the average output voltage of a three phase half wave converter 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 figure 3. Assume firing angle to be \( \pi/3 \). (12)

5. With the help of a circuit diagram and waveforms explain the working of (ANY TWO) of the following:
   a. A single phase dual converter.
   b. A single phase cycloconverter.
   c. A single phase ac voltage controller (12)
2016-17  
B.E. (AUTUMN SEMESTER) EXAMINATION  
ELECTRICAL  
ELECTRICAL POWER GENERATION AND UTILIZATION  
EEE-331

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>
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<tbody>
<tr>
<td>Q.1. (a)</td>
<td>Write down the basic nuclear reaction that takes place in Uranium based Nuclear Power Plant.</td>
<td>2</td>
</tr>
<tr>
<td>(b)</td>
<td>Mention the pollutants associated with the Thermal Power Plant.</td>
<td>2</td>
</tr>
<tr>
<td>(c)</td>
<td>Draw a labelled diagram of a nuclear reactor. Write in brief the function of the moderator.</td>
<td>4</td>
</tr>
</tbody>
</table>

OR

(c') | Draw the labelled diagram of Boiling Water Reactor based Nuclear Power Plant. Also write any two problems associated with this arrangement. | 4 |
| (d) | Draw the basic block diagram of a Thermal Power Plant and draw its corresponding T-S diagram. Note: Mention the components in the block diagram and on the T-S curve. | 4 |

OR

(d') | Write in brief about the Cooling Towers and Super heater employed in a Thermal Power Plant. | 4 |

Q.2. (a) | Water is dropped from the height of 50 m onto turbine blades. The rate of flow of water through the head is 1 m³/sec. If the efficiency of the turbine-alternator combination is 90 %, find the electrical output power available. | 2 |
| (b) | Name the curve (drawn on temperature-entropy graph) that is employed to explain the working of a Gas Turbine based Power Plant (GTPP). Draw this curve for an open cycle GTPP. | 3 |
| (c) | Discuss how the exhaust of the gas turbine can be utilized when steam and gas | 7 |

contd...
turbine power plants are employed in combination. Discuss in brief the methods that pertain to this combination.

OR

(c') Classify the Hydro Electric Power Plants based on different parameters. Draw simple diagrams to show the possible placements of a dam.

Q.3. (a) Describe Distributed Power generation.
(b) Discuss any two Cogeneration Technologies in brief.
(c) Discuss any two types of Captive power plants in brief.

Q.4. (a) Explain in brief a method employed to connect the traction motors of one unit from series to parallel.

OR

(a') Discuss the current collection systems employed in traction.
(b) An electric train has a quadrilateral speed time curve defined as follows:
   i. Uniform acceleration of 2.2 km/hr/sec for 30 sec;
   ii. Coasting time for 50 sec;
   iii. Duration of braking for 20 sec.
   If the train is moving on a uniform up gradient of 10%, train resistance is 40 N/tonne, rotational inertia effect 10% of dead weight, duration of station stop as 15 sec and overall efficiency of transmission gear and motor as 75%; find the schedule speed and specific energy consumption of the run.

OR

(b') Derive the expression of maximum velocity and the relationship between $\alpha$ and $\beta$ for Trapezoidal Speed-Time curve. Also explain in brief, the difference between the schedule speed and the average speed of a train.

Q.5. (a) Define any three the following terms:
   i. Plane Angle
   ii. Solid Angle
   iii. Luminous Intensity
   iv. Illumination

(b) Write the expressions for the laws of illumination.
   A 250 CP lamp is hung 3 m high above the centre of a circular area of 8 m diameter. Calculate:
   i. the illumination at the centre of the area;
   ii. the illumination at the periphery of the area;
   iii. Average illumination.

OR

(b') Discuss various components of a lead-acid battery in brief.
1(a) Discuss the classifications of transducers.
(b) Name the transducers which can perform the following operations.
   a) Displacement to displacement   b) Temperature to voltage
   c) Pressure to displacement       c) Velocity to pressure
   d) Displacement to voltage        d) Light intensity to voltage

2(a) Write a short note on signal conditioning system.

OR

2(a)' Briefly explain construction, principle and operation of LVDT.

2(b) The output of an LVDT is connected to a 10 V voltmeter through an amplifier
     whose amplification factor is 500. An output of 4 mV appears across the terminal of
     LVDT when the core moves through a distance of 1 mm. Calculate the sensitivity of
     the LVDT and that of the whole setup. The voltmeter scale has 100 divisions. The
     scale can be read to 1/10 of a division, calculate the resolution of the instruments in
     mm.

OR

2(b)' A capacitive transducer is made up of two concentric cylindrical electrodes. The
      outer diameter of the inner cylindrical electrode is 4 mm and the dielectric medium
      is air. The inner diameter of the outer electrode is 4.2 mm. Calculate the dielectric
      stress when a voltage of 100 V is applied across the electrodes. Is it within safe
      limits? The length of electrodes is 20 mm. Calculate the change in capacitance if the
      inner electrode is moved through a distance of 2 mm. The breakdown strength of air
      is 2.5 kV/mm.
3(a). Explain the principle of operation of a true rms responding voltmeter with the help of a suitable block diagram.

3(b). A thermocouple produces an e.m.f. in mV according to the temperature difference between the sensor tip \( \theta_1 \) and the gauge head \( \theta_2 \) such that \( e = \alpha(\theta_1 - \theta_2) + \beta(\theta_1^2 - \theta_2^2) \)
\( \alpha = 3.5 \times 10^{-2} \) and \( \beta = 8.2 \times 10^{-6} \). The gauge head is at \( 20^\circ C \). The mV output is 12 mV. Calculate the temperature at the sensor.

\[ \text{OR} \]

3(b'). A compressive force is applied to a structural member. The strain is 5 micro-strain.

Two separate strain gauges are attached to the structural member, one is a nickel wire strain gauge having a gauge factor of -12.1 and the other is nichrome wire strain gauge having a gauge factor of 2. Calculate the value of resistance of the gauges after they are strained. The resistance of strain gauges before being strained is 100 \( \Omega \).


\[ \text{OR} \]

4(a'). Explain basic principles of telemetry.

4(b). Three channels, one with a bit rate of 190kbps and second with a bit rate 180 kbps and the third one with a bit rate of 200kbps are to be multiplexed using g pulse stuffing TDM with no synchronization bits. Answer the following questions:

i. What is the size of a frame in bits?

ii. What is the frame rate?

iii. What is the duration of a frame?

iv. What is the data rate?

5. Describe briefly about (ANY TWO) of the following

a) MEMS based Sensors.

b) Smart Sensors

c) Intelligent Instrumentation

d) Virtual Instrumentation
### Questions

**Q.No.** | **Questions** | **M.M. 60**
--- | --- | ---
1.(a) | With suitable figures, briefly explain Streamer theory for breakdown of gases under uniform field. | [6]
1.(b) | Explain the breakdown in solid dielectric due to *Treeing* and *Tracking*. | [6]

**OR**

1'.(a) | Enumerate any one of the ionization processes responsible for breakdown in gases. Define Townsend's first and second ionization coefficients. | [6]
1'.(b) | Explain any one theory that explains breakdown in commercial liquid dielectrics. | [6]

2.(a) | Explain the working of voltage doubler circuit for generation of high DC voltage. | [6]
2.(b) | Show that the output voltage of RC type impulse voltage generator is in the form of double exponential equation. | [6]

**OR**

2'.(a) | What is the need of triggering circuit? Describe in brief the working of a Trigatron gap. | [6]
2'.(b) | With the help of neat circuit diagram, explain in brief the working of cascaded unit transformer. | [6]

3.(a) | Discuss the working of generating voltmeter for measurement of high dc voltages. | [6]
3.(b) | Explain the working of uniform field electrode spark gap method used for measurement of high voltages. | [6]

**OR**

3.(b') | With the help of a neat sketch explain the Electrostatic voltmeter method for measurement of high voltages. | [6]

*contd...*
4.(a) Define the following terms: (a) PDIV (b) PDEV and (c) Apparent charge.

4.(b) Define loss index and briefly explain a suitable method for the measurement of loss tangent of a dielectric.

OR

4.(b') What are the causes of partial discharges in solid insulation? With the help of equivalent circuit, show the recurrence of PD pulses when A.C. voltage is applied.

5.(a) Discuss in brief different types of power frequency tests performed on disc insulators.

5.(b) Differentiate between type and routine test. What are the different types of test performed on power cables?
Maximum Marks: 60

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>Define monopoly and perfect competition type of market condition with suitable examples.</td>
<td>[03]</td>
</tr>
<tr>
<td>1(b)</td>
<td>An industry owner wants to implement a new technology to increase plant manufacturing capacity. He has two alternatives with initial outlay of Rs. 360,000 and Rs. 295,000 with operation cost Rs. 42,000 and Rs. 47,000 annually and the maintenance cost at the end of every four year is Rs. 72000 and Rs. 69000 respectively. Salvage values are Rs. 5000 and Rs. 4000 at the end of their lives respectively. Which option should be selected using Annual Equivalent method, if the lives of alternatives are 7 and 5 years respectively? Assume a rate of interest as 9 % compounded annually.</td>
<td>[09]</td>
</tr>
<tr>
<td>2</td>
<td>A machine was purchased two years ago for Rs. 10,000. The annual maintenance cost of machine is Rs. 750. The salvage value at the end of its 6 years is Rs. 1,000. Now, a company is offering a new machine at a cost of Rs. 10,000. The salvage value at the end of its 4 year life is Rs. 4,000. The annual maintenance cost of the new machine is Rs. 500. The company which is supplying the new machine is willing to take the old machine back for Rs. 8,000 if it is replaced by the new machine. Assuming an interest rate of 12%, compounded annually, find the present value of both the machines. Is it advisable to replace the old machine?</td>
<td>[12]</td>
</tr>
<tr>
<td>2'(a)</td>
<td>What are the methods of calculating depreciation? Explain any one.</td>
<td>[04]</td>
</tr>
<tr>
<td>2'(b)</td>
<td>A Drug Company has just purchased a capsulation machine for Rs. 20,000,000. The plant engineer estimates that the machine has a useful life of five years and a salvage value of Rs. 25,000 at the end of its life. Compute the depreciation schedule for the machine using Double Declining balance method of depreciation.</td>
<td>[08]</td>
</tr>
</tbody>
</table>

...contd... 2.
3(a) What is management? Explain the functions of management.  [06]
3(b) What are the various techniques of decision making? Explain any one.  [06]
4 What are the principles of organisation design? Discuss in detail.  [12]

OR

4'(a) What do you mean by leadership? Briefly Discuss the leadership styles  [06]
4'(b) What are the theories of motivation? Explain Maslow's theory of hierarchy of needs.  [06]
5(a) What do you mean by quality? Explain any two quality control tools.  [06]
5(b) What is marketing management? Explain Marketing Mix.  [06]