Q.No. | Question                                                                                                                                | M.M. |
------|----------------------------------------------------------------------------------------------------------------------------------------|------|
1(a)  | Draw and explain the i-v characteristics of a thyristor and explain the following terms:                                             | 08   |
      | i) Latching current                                                                                                                   |      |
      | ii) Holding current                                                                                                                   |      |
1(b)  | Draw the circuit symbol and i-v characteristics of a GTO. What are the disadvantages of GTO over an SCR?                               | 04   |

OR

1(b') | Draw the circuit symbol and i-v characteristics of a TRIAC. What are the different modes of triggering of TRIAC?                    | 04   |

2    | What are the different requirements that the triggering circuit of an SCR must satisfy? With the help of neat diagram and relevant waveforms explain the R triggering circuit. | 12   |

OR

2'   | With the help of neat sketch explain the working of a UJT based firing circuit that can be used to trigger thyristors of single-phase ac voltage regulator. | 12   |

3(a) | Draw the waveforms of output voltage and source current of a single-phase bridge converter supplying an RL load. Assume load current to be continuous and ripple free and take \( \alpha < 90^\circ \). Find the expression for Form factor and Ripple factor. | 07   |

OR
3(a) Draw the circuit of a single-phase mid-point converter supplying a resistive load. Draw the waveforms of load voltage and anode to cathode voltages across the thyristors for $\alpha = 90^\circ$. Find the expression of the output voltage.

3(b) A single-phase bridge converter with source voltage of 150V supplies power to an RL load with $R = 10 \, \Omega$. For a firing angle of $60^\circ$ find (i) average load voltage (ii) rms value of load voltage (iii) average load current (iv) rms value of source current (v) Power supplied to the load. Assume load current to be continuous and ripple-free.

4. Draw the circuit of a three-phase bridge-converter. If the converter is supplying an RL load, draw the waveforms of the 3-phase input voltage, output voltage, current through any one thyristor and currents through the three phases of the input source for $\alpha = 60$ degrees. Clearly indicate the conduction interval of each device. Assume load current to be continuous and ripple-free.

5. With the help of a block diagram and relevant waveforms, explain the ramp firing scheme used for triggering SCRs of a single-phase full wave converter. What is the drawback of this scheme over cosine firing scheme?

OR

5' What is a dual converter? Draw its circuit and explain its operation with simultaneous control. What are the advantages of simultaneous control over non-simultaneous control.
1. Draw water-steam flow diagram of a thermal power plant. Discuss briefly about condenser and cooling tower.

OR

1'. Draw flue gas flow diagram of a thermal power plant. Discuss briefly about economizer and draft system.

2. With the help of a diagram explain the working of combined cycle power plant.

3(a). What are the different cogeneration technologies? Explain any one with the help of diagram.

3(b). What are the advantages and disadvantage of captive power plant? List down the different type of captive power plant.

4(a). Two similar lamps having uniform intensity of 500 C. P. in all directions below the horizontal are mounted at a height of 4 meters. What must be the maximum spacing between the lamps so that the illumination on ground midway between the lamps shall be at least one half of the illumination directly under the lamp?

OR

4(a'). What are the requirements of good lighting? Describe direct lighting and general diffusing lighting schemes. Name the other types of lighting schemes?

4(b). What is electroplating and write its applications? Describe the various operations involved in electroplating.

5. A train is required to run between two stations 1.6 Km apart at the average speed of 40 Km/hr. The acceleration and retardation during coasting and braking are 2Km/hr/sec, 0.16 Km/hr/sec and 3.2Km/hr/sec respectively. Assuming quadrilateral approximation of speed-time curve, find:

Duration of acceleration, coasting and braking periods.

OR

5'(a). With the help of a neat sketch discuss the construction and working of a pantograph collector.

5'(b). Make a comparison between AC and DC systems of railway electrification from the point of view of main line and sub-urban line railway service.
Q. No. | Questions
--- | ---
1 (a) | Using suitable waveforms derive the expression for measurement of AC power in a digital wattmeter.
1 (b) | Draw the block diagram of period measurement circuit employing Gate Control Flip Flop. If unknown time period $t_x = 4.5 \, T_o$, where $T_o$ is oscillator time period, find the percentage error in the measurement if one decade counter is used.

OR

1' (a) | Draw suitable waveforms for measurement of time period using Vernier technique and show that

$$t_m = t_x + \left( \frac{b}{\Delta T} \right) T_v$$

Where,

$t_x = cT_m + b$

$T_m$ is the time period of main oscillator
$c$ is an integer and $b/T_m$ is a proper fraction
$t_m$ is the total time of measurement
$T_v$ is the time period of Vernier oscillator
$t_x$ is the unknown time period
$\Delta T$ is the difference between time periods of Main oscillator $(T_m)$ and Vernier oscillator $(T_v)$

1' (b) | Draw block diagram and waveforms of a Dual Slope Digital voltmeter.

2 (a) | Obtain the expressions for the instantaneous amplitudes of Frequency Modulated signals and show the relevant waveforms.

2 (b) | Explain the operation of a Data Acquisition system multiplexing the inputs of the sample and hold circuit.
OR

2'(a) With the help of suitable waveforms, show the generation of PPM signals.

2'(b) With the help of suitable waveforms show various pulse coded modulation schemes.

3 (a) Using the following values of resistance versus temperature for a RTD, find the linear approximation between 30°C and 60°C.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>3.2</td>
</tr>
<tr>
<td>30</td>
<td>4.8</td>
</tr>
<tr>
<td>45</td>
<td>5.5</td>
</tr>
<tr>
<td>60</td>
<td>6.2</td>
</tr>
<tr>
<td>75</td>
<td>7.3</td>
</tr>
</tbody>
</table>

3 (b) In a Gyroscope, show that when input torque is applied along x-axis with initial spin axis along z axis, the recession of the Gyroscope is along y axis.

OR

3'(b) Explain how power can be measured using Hall Effect Multipliers.

4 (a) Using appropriate diagrams, describe the working of an Ultrasonic Transducer. How thickness of the crystal is selected in Ultrasonic Transducers?

4 (b) Explain the operation of an inductive transducer used for measurement of pressure.

OR

4'(b) Explain the operation of an optical pyrometer.

5 (a) With the help of daily load curve, explain the role of Smart meters in the economical operation of the grid.

5 (b) Describe any two of the following terms of Global Positioning System in brief:
   i) Trilateration
   ii) Differential GPS
   iii) Ephemeris
2016-17
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
HIGH VOLTAGE ENGINEERING
EE-361

Maximum Marks: 60 Credits: 04 Duration: Two Hours

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

Q.No. 
1(a) Describe the current growth phenomenon in a gas subjected to uniform electric fields and hence develop an expression which gives the condition for breakdown. 

1(b) Explain the different mechanisms by which breakdown occurs in liquid dielectrics. 

1’a) Describe the various factors that influence breakdown in a gas and hence explainStreamer Theory for breakdown of gases under uniform field conditions. Justify assumptions, if any.

1’(b) What is Paschen’s law? From Townsend’s Breakdown Theory develop expression giving the minimum voltage for breakdown of a gas under a given ‘p x d’ condition?

2(a) With a neat sketch, explain the principle of operation of a 3-stage cascaded transformer connection for generation of high a.c. voltages,

2(b) Define standard lightening impulse and switching surges as per Indian standards. Develop expressions for wave front and wave tail time using the approximate circuit analysis of basic Marx Circuit.

OR

2’ Explain the principle of operation of voltage doubler circuit as given by Greinacher. How is it applied to a n-stage Cockcroft-Walton type voltage multiplier circuit for generation of high D.C. voltages. Deduce an expression for optimum number of stages for such a multi-stage generator under load.

3 Enumerate different methods for measurement of high voltages. Explain the principle of operation of the following for high voltages measurements:
   (a) Peak voltmeter.
   (b) Generating Voltmeter.

OR

3’ What are the problems associated with measurement of very high impulse voltages? Explain oscillation free recording of impulse voltages.
4(a) What is the significance of non-destructive high voltage tests? Explain the use of Schering bridge for the measurement of loss tangent.

4(b) Define PDIV and PDEV as applicable to partial discharges. Draw an analogue circuit and hence determine the expression for PDIV for discharge in voids.

5(a) Distinguish between type and routine test.

5(b) Enumerate the various tests performed on a cable. Explain the need for partial discharge testing of cables and its importance as a test parameter.

5(c) What is Condition Monitoring? With the help of an example explain how it is implemented.
1a Explain the law of diminishing return with the help of suitable examples. [05]

OR

a' Differentiate between consumer and producer goods/services. Why it is more difficult to estimate the demand for producer goods? [05]

b For purchasing a universal testing machine, two options are available. The cash flow details of two options are presented below:

<table>
<thead>
<tr>
<th></th>
<th>Option-1</th>
<th>Option-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial purchase price (Rs.)</td>
<td>17,00,000</td>
<td>21,00,000</td>
</tr>
<tr>
<td>Annual operating cost (Rs.)</td>
<td>45,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Expected salvage value (Rs.)</td>
<td>3,70,000</td>
<td>4,50,000</td>
</tr>
<tr>
<td>Useful life</td>
<td>6 years</td>
<td>12 years</td>
</tr>
</tbody>
</table>

Find out the most economical alternative at a interest rate of 9% per year compounded bi-annually.

2 Answer any TWO of the following.

a. Cash flow details of four mutually exclusive alternatives for a public project are presented below:

<table>
<thead>
<tr>
<th></th>
<th>Alt 1</th>
<th>Alt 2</th>
<th>Alt 3</th>
<th>Alt 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial investment(Rs.) (*10^3)</td>
<td>161,500</td>
<td>203,000</td>
<td>146,000</td>
<td>173,500</td>
</tr>
<tr>
<td>Annual operating &amp; maintenance cost (Rs.) (*10^3)</td>
<td>8,220</td>
<td>7,630</td>
<td>8,640</td>
<td>7,975</td>
</tr>
<tr>
<td>Annual benefits (Rs.) (*10^3)</td>
<td>22,750</td>
<td>26,500</td>
<td>21,500</td>
<td>23,800</td>
</tr>
<tr>
<td>Useful life (years)</td>
<td>45</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
</tbody>
</table>

According to you which is the best alternative on the basis of an incremental benefit cost analysis, if interest rate is 8% per year. Why?
b. A construction firm purchased a piece of construction equipment 4 years ago at a cost of Rs.55,00,000. The current market value of the equipment is Rs.37,65,000. The estimated salvage value, annual operating cost and remaining life of the equipment are Rs.8,00,000, Rs.1,40,000 and 9 years respectively. The firm is now considering replacement of the existing equipment with a new model. The initial cost of the new model is Rs.44,00,000. The estimated life and salvage value of the new model are 9 years and Rs.10,70,000 respectively. The annual operating cost is Rs.1,30,000. The construction firm's MARR is 12% per year. By using 9 year study period, determine whether the construction firm should continue with the existing equipment or replace it with the new model.

c. Define "depreciation". Why it is calculated? The initial cost and useful life of an asset are Rs.18,00,000 and 11 years respectively. The estimated salvage value of the asset at the end of useful life is zero. Determine annual depreciation and book value using declining balance method. Find out the year in which the switching from declining balance method to straight-line method takes place.

3a How managers can be differentiated in a typical organization? Explain them through a block diagram.

OR

a' Differentiate between "data" and "information". Enumerate the different characteristics of useful information that a manager generally receives.

b. Explain Delphi and Nominal Group methods of decision making. A company is manufacturing a gate valve, which it sells @ $115 and has a fixed cost equal to $120,000 and variable cost @ $65. Obtain the number of gate valves to be produced to break-even the production.

4 Differentiate between any THREE of the following:
   i. Coercive Power and Referent Power
   ii. Job-centred behaviour and Employee-centred behaviour
   iii. Tall organizations and Flat Organizations
   iv. Strategic goals and Tactical goals

OR

4' Define the meaning of "Control" in an organization? What are the fundamental steps that should be followed in implementing controlling process? Explain them by using a flow diagram.
5. Answer any TWO of the following:

a. The Director of a Technical and Management Institute wants to forecast student enrolments for this academic year based on the following historical data:

<table>
<thead>
<tr>
<th>Academic Year (t)</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Demand (D_t)</td>
<td>15,000</td>
<td>16,000</td>
<td>18,000</td>
<td>20,000</td>
<td>21,000</td>
</tr>
</tbody>
</table>

i. What is the forecast for this year using exponential smoothing with $\alpha = 0.4$, if the forecast for three years ago was 16,000?

ii. What are your forecasts using 3-period moving average? Compare the results of the two methods for the year 2016 and give your recommendations.

b. What is "Market"? List the types of markets that are used by sellers and buyers in a modern exchange economy. Discuss any five types of entities that the marketing managers markets to keep their target customers updated.

c. What procedure the human resource managers adopt while planning human resource for any business organization? Explain it through a flow diagram.