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

Q.No. Question M.M.

1(a) Draw and explain the turn-on characteristics of an SCR. Define the following terms:
   i) Delay time
   ii) Rise Time
   iii) Turn-on time

1(b) Draw the circuit symbols and i-v characteristics of the following power semiconductor devices:
   i) TRIAC
   ii) GTO
   iii) RCT

Under what conditions these devices are used?

OR

1' (a) What are the characteristics of an ideal switch? How is a practical switch different from an ideal switch? Draw the switching characteristics and explain the different losses of a practical switch.

1' (b) Explain why a thyristor needs to be protected against fast rise of anode current. Draw and explain a circuit that can be used for this purpose.

2(a) With the help of neat sketch and relevant waveforms, explain the working of a resistance triggering circuit for an SCR. What are the advantages and disadvantages of this triggering circuit?

2(b) With the help of neat sketch explain the working of a UJT relaxation oscillator based triggering circuit of an SCR.

3. Draw the waveform of output voltage and source current of a two-pulse semiconductor converter for a firing angle \( \alpha < 90^\circ \) and show that the fundamental component of the source current is given by

\[
i_{st} = \frac{4I_a}{\pi} \cos(\alpha/2) \sin(\alpha - \alpha/2)
\]

Where \( I_a \) is the magnitude of the ripple-free output current.
3' (a) Draw circuit of a single-phase mid-point converter supplying a resistive load. Draw the waveform of load voltage, voltage across any one thyristor, current through any one thyristor and the source current for $\alpha = 90^\circ$. What will be the average values of load current and source current if secondary voltage of the transformer is given to be 200V?

3' (b) A single-phase bridge converter is supplied from a 120V source with an R-L load with resistance of 10 $\Omega$. Assuming load current to be continuous and ripple-free, calculate the following for $\alpha = 30^\circ$:
   (a) Average load voltage (b) Average, rms and peak values of load current (c) Average SCR current. (d) Power supplied to the load (e) Form factor (f) Ripple factor

4. Draw the circuit of a three-phase bridge semi-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 current through any one phase of the input source for $\alpha = 30$ degrees. Clearly indicate the conduction interval of each device. Determine the average value of the output voltage if the line-to-line input voltage is given to be 400 volts. Assume load current to be continuous and ripple-free.

OR

4' (a) Draw circuit of a three-phase half-wave converter. The converter is supplying a purely resistive load. Draw the waveform of the output voltage and current through any one thyristor for $\alpha = 60^\circ$. What will be average output voltage for $\alpha = 150^\circ$? Secondary voltage of the transformer is given to be 100V/phase.

4' (b) A three-phase fully controlled Bridge converter with source voltage of 220V supplies power to a highly inductive load with a resistance of 20 $\Omega$. For $\alpha = 30^\circ$, find
   i) average output voltage and current
   ii) rms output voltage and current
   iii) average and rms SCR currents

5. With the help of neat sketch and relevant waveforms, explain the cosine firing scheme used for triggering SCRs of a single-phase full wave converter. Show that the output voltage of the converter is directly proportional to the control voltage of the firing circuit.
2014-15
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL
ELECTRICAL POWER GENERATION AND UTILIZATION
EE-331

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Q1(a) Discuss about radioactivity and the radiations emitted during the process of radioactive decay. Also, Find the average binding energy per nucleon for heavy hydrogen \(1H_2\) (atomic mass=2.0141amu)

OR

(a') Explain nuclear chain reaction. Also define the purpose and different properties of moderator materials.

(b) Draw water steam flow diagram of thermal power plant. Discuss briefly about condenser and cooling tower of thermal power plant.

Q2(a) What are the different aspects which should be taken into consideration while selecting a site for hydro power plant? Discuss them.

OR

(a') Explain with the help of a diagram the combined cycle of gas turbine plant. Also make the comparison between open cycle and closed cycle gas turbine plant

(b) What are the different type of hydraulic turbines? Explain any one with the help of clean diagram.

Q3(a) What are the different co-generation technologies? With the help of diagram explain them.

(b) What are the different type of captive power plant. Also enumerate the advantages and disadvantage of captive power plant

OR

(b') With the help of diagram discuss the working of implant power generation system.

Q4(a) Answer the following questions:

Contd...
i. What do you understand by direct, indirect and semi-indirect lighting?

ii. What are the advantages of adding a small amount of Halogen gas with the filling gas in lamps?

iii. What is meant by anodizing? Explain the process of anodizing.

iv. What do you understand by terms stratification and sulfation?

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

OR

(b') It is desired to illuminate a drawing hall with an average illumination of 250 lux. The area of the hall is 30x20 m². The lamps are to be fitted at 5 m height. Find out the number and size of incandescent lamps required for an efficiency of 12 lumens/watt. Take utilization and maintenance factors as 0.4 and 0.85 respectively.

Q5(a) What are the requirements of an ideal traction system? Name the different traction systems. Enumerate the merits and demerits of electric traction system over steam engine traction.

OR

(a') What is tractive effort of a train and what are its functions? Derive an expression for the tractive effort developed by a train unit.

(b) The average distance between stops on a level section of a railway is 1.25 Km. Motor coach train weighing 200 tonne has a schedule speed of 30 Km/h, the duration of stops being 30 seconds. The acceleration is 1.9 km/hr/sec and braking retardation 3.2 km/hr/sec. Train resistance to traction is 45 N/t. Allowance for rotational inertia is 10%. Calculate the specific energy output in Wh/t-km. Assume a trapezoidal speed time curve
### Questions

#### 1(a)
Find the transfer function of the following state space equation

\[
\begin{bmatrix}
\dot{x}_1 \\
\dot{x}_2
\end{bmatrix} = \begin{bmatrix}
2 & 5 \\
4 & 11
\end{bmatrix}\begin{bmatrix}
x_1 \\
x_2
\end{bmatrix} + \begin{bmatrix}
0 \\
1
\end{bmatrix} u(t)
\]

\[
y = \begin{bmatrix}
1 \\
0
\end{bmatrix}^T \begin{bmatrix}
x_1 \\
x_2
\end{bmatrix}
\]

#### 1(b)
Convert the following mechanical system into Force-Current analogy as shown in figure 1

[Diagram of a mechanical system with labeled components B1, B2, K1, K2, M1, M2, and x1, x2]

#### OR

#### 1'(a)
Find the transfer function represented by \(c(t) + 2c(t) = r(t)\) and hence find the response \(c(t)\) to an input \(r(t) = u(t)\), a unit step input

#### 1'(b)
Develop a state space model for the electrical network as shown in figure 2

[Diagram of an electrical network with labeled components and variables x1, x2, x3, R, L1, L2, C, V1, and V2]

### Maximum Marks: 60

Assume suitable data if missing.

Notations used have their usual meaning.

Attempt all the questions
2(a) Convert the following algebraic equation into signal flow graph and hence find $y_2/y_1$.

\[
\begin{align*}
y_2 &= a_{12}y_1 + a_{32}y_3 \\
y_3 &= a_{23}y_2 + a_{43}y_4 \\
y_4 &= a_{34}y_3 + a_{24}y_2 + a_{44}y_4 \\
y_5 &= a_{45}y_4 + a_{25}y_2
\end{align*}
\]

2(b) Convert the following transfer function into its state diagram

\[
\frac{Y(s)}{R(s)} = \frac{s^2 + s + 1}{s^3 + s^2 + s + 2}
\]

OR

2(a) Develop the transfer function model of armature controlled DC Servomotor

2(b) Convert the block diagram as shown in figure 3 into its signal flow graph and hence find the transfer function

![Block Diagram](image)

Figure 3

3(a) Find damping ratio, undamped natural frequency, damped frequency, rise time, peak time, settling time and peak overshoot for a system whose transfer function

\[
G(s) = \frac{361}{s^2 + 16s + 361}
\]

3(b) Given the unity feedback system with open loop transfer function $G(s) = \frac{K(s+4)}{s(s+1)(s+2)}$, Find the following:

(i) Range of K that keeps the system stable
(ii) Value of K that makes the system oscillate
(iii) Frequency of oscillation when the value of K makes the system oscillate

OR

3(a) Discuss qualitatively of the effect of addition of poles and zeros to the prototype second order system.

3(b) Construct the Root Locus on your answer book roughly of the following equation

\[
s^2 + 2s + K = 0
\]

4 Draw Nyquist plot and determine the stability of closed loop system whose open loop transfer function is given as $G(s)H(s) = \frac{10}{(1+2s)(1+8s)}$

5(a) Differentiate between Lead and Lag Compensation.

5(b) With the help of op-amp circuit realize PD, PI and PID controller
2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ELECTRICAL AND ELECTRONIC INSTRUMENTATION
EE-352N

Maximum Marks: 60          Credits: 04          Duration: Three Hours

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

Q.No.        Question                                                                                             M.M.
1(a)   Explain the working of a Dual Slope (voltage to time conversion) Analog to Digital Converter.          [06]
1(b)   With the help of suitable waveforms, explain the working of a digital wattmeter.                   [06]
2(a)   What is telemetry? Briefly discuss the torque transmission mode of a Synchro Transmitter-Receiver pair used in position telemetry system. [06]
2(b)   Explain the working of a Multi-channel Data Acquisition System using Digital Multiplexing. What are its advantages over the other types of Data Acquisition Systems? [06]

OR

2'(a)   Obtain the expression for the instantaneous amplitude of Amplitude Modulated signals and show the relevant waveforms. Obtain the expression for maximum frequency deviation in Frequency modulated signal. [06]
2'(b)   Discuss the merits and demerits of Synchronous and Asynchronous Time Division Multiplexing. Also show their frame structure. [06]
3 (a)   Using VI characteristics of a thermistor, explain how a thermistor can be used to measure liquid flow or pressure? [04]
3 (b)   Briefly explain how Hall effect transducer can be used as a proximity sensor to detect change in the geometry of a magnetic structure? [04]
3 (c)   If \( C_p \) is the capacitance of a piezoelectric transducer and a load having capacitance \( C_L \) and leakage resistance \( R_L \) is connected across the transducer. Derive the expression for output voltage. Also show that piezoelectric transducers cannot be used for static measurements. [04]

OR

3'(a)   Briefly explain the working of a Photo Emissive Cell. Why is the sensitivity of gas filled photo emissive cells better than that of a vacuum type photo emissive cell? [05]
3'(b)   Discuss the temperature compensation of a circuit using thermistors [04]
3'(c)   Why a three lead wire RTD (Resistance Thermometer) is used while measuring temperature using an RTD in bridge configuration. [03]
4(a) Discuss the factors affecting the resolution of an Ultrasonic Transducers. What is the effect of resonant frequency on Ultrasonic Transducers? [06]

4(b) Briefly explain how current can be measured in a circuit with the help of fibre optic cables utilizing the polarization technique. [06]

OR

4'(a) Explain the operation of an Ultrasonic Flow Transducer. [06]

4'(b) Briefly describe the working of a 3 bit shaft encoder for the measurement of angular displacement. What is the advantage of using gray coded shaft encoder instead of binary coded encoder. [06]

5(a) Why is MEMS based sensor superior to an ordinary sensor? Discuss a type of a MEMS based sensor. [07]

5(b) Discuss Atomic Force Microscopy (AFM) technique to determine the topology of surfaces. [05]
2014-15
B.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
High Voltage Engineering
EE – 361

Maximum Marks: 60 Credits: 04 Duration: Three Hours

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

Q.No. M.M.

1(a) Discuss Streamer theory with suitable figures for breakdown in gases under uniform field conditions. State the conditions under which this theory is applicable. [06]

(b) Explain electrochemical deterioration and intrinsic breakdown mechanism in solid dielectrics. Also draw the curve showing the variation of breakdown strength with time depicting the mechanism of breakdown in solid dielectrics. [06]

OR

1'(a) Define Townsend's primary and secondary ionization coefficients and hence derive Townsend's breakdown equation of a gas under uniform fields. Why breakdown strength is higher in electronegative gases? [06]

(b) Explain the phenomena of electrical conduction in pure liquids showing the conduction current-electric field characteristics. How does it differ from the gases? [06]

2(a) Define standard lightning impulse and switching surges as per Indian standards. Show that the output voltage for a single stage impulse generator is double exponential equation. [06]

(b) With the help of a neat sketch explain the working of Van de Graaff generator for generating high dc voltages. What are the advantages and limitations of this method? [06]

OR

2'(a) Explain how high frequency high voltages are generated. What are its advantages and applications? [05]
(b) With the help of a neat sketch describe the working of Cockcroft Walton voltage multiplier circuit for generation of high dc voltages. Why is it desirable to increase capacitance in lower stages in the circuit? 

3(a) Discuss the sphere gap method used for measurement of high voltages. Also discuss the effect of humidity and nearby earthed objects on the measurements using this method. 

(b) With the help of a neat sketch explain the Chubb and Fortescue method used for the measurement of high voltages. Also explain how the influence of frequency on the reading is eliminated. 

OR

(b') With the help of a neat sketch explain measurement of ac voltages by Electrostatic voltmeter. What are its advantages and limitations? 

4(a) What is the significance of non-destructive high voltage tests? Explain the Schering bridge used for the measurement of loss tangent. 

(b) Define PDIV and PDEV. Draw an analogue circuit and hence determine the expression for PDIV for discharge in voids. 

5(a) Distinguish between type and routine test. 

(b) Enumerate the various tests performed on a cable. Why PD test is performed and is treated as an important test parameter. 

(c) What is Condition Monitoring? With the help of an example explain how it is implemented.
Answer all the questions.
Assume suitable data if missing.

1. a. What is monopoly? Give examples of some situations where it would be beneficial. Also explain how the price of a product may be determined in a monopoly.
   
   b. Explain the Law of Diminishing returns with suitable examples.

   c. A company 3 years ago borrowed Rs. 40,000 to pay for a new machine tool agreeing to repay the loan in 100 monthly instalments at an annual nominal interest rate of 12% compounded monthly. The company now wants to pay off the loan. How much would this payment be, assuming no penalty cost for early payment?

   OR

1. a. What is inflation? What are its causes? How does it affect the economy of a nation?

   b. Machines that have the following costs are under consideration for a robotized welding process. Using an interest rate of 10% per year, determine which alternative should be selected:

<table>
<thead>
<tr>
<th>Machine X</th>
<th>Machine Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Cost (Rs)</td>
<td>250,000</td>
</tr>
<tr>
<td>Annual operating cost (Rs/year)</td>
<td>60,000</td>
</tr>
<tr>
<td>Salvage Value (Rs)</td>
<td>70,000</td>
</tr>
<tr>
<td>Life (Years)</td>
<td>3</td>
</tr>
</tbody>
</table>

2. a. What is depreciation? What is the need for calculating it?

   b. Differentiate between defender and challenger.

   It is proposed to replace a two year old precision measuring instrument immediately. The expected costs and lives of the two instruments are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Proposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original purchase price (Rs.)</td>
<td>30,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Current market value (Rs.)</td>
<td>17,000</td>
<td>-</td>
</tr>
<tr>
<td>Remaining life (years)</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Estimated value in 3 years (Rs.)</td>
<td>9,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Annual operating cost (Rs.)</td>
<td>8,000</td>
<td>3,000</td>
</tr>
</tbody>
</table>

   Perform the replacement study for a 3 year replacement period.

   c. Five interdependent proposals are under consideration for a particular project. The present worth of capital requirement and benefits for each project are as follows:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW of Capital (Rs.)</td>
<td>80,000</td>
<td>50,000</td>
<td>72,000</td>
<td>43,000</td>
<td>81,000</td>
</tr>
<tr>
<td>PW of Benefits (Rs.)</td>
<td>70,000</td>
<td>55,000</td>
<td>76,000</td>
<td>52,000</td>
<td>84,000</td>
</tr>
</tbody>
</table>

   Select the best proposal on the basis of an incremental B/C analysis.
3 a. What is the significance of decision making tools? Discuss any one decision making tool with suitable examples.  

b. What are the major areas of social responsibility of corporate sector? Discuss the implications of corporate involvement in social causes.  

OR

3' a. Discuss the role of information in the manager's job. Also, state the characteristics of useful information.  

b. Discuss the Administrative model of decision making.  

4 a. Why are organisational goals important? How are they classified? What are the differences between strategic goals and tactical goals?  

b. Differentiate between:  
   i. Job enlargement and Job enrichment  
   ii. Functional departmentalization and Product departmentalization  

OR

4' a. Discuss how control helps the organization. What are the steps involved in the control process?  

b. How is authority different from power? Differentiate between line and staff authority with suitable examples.  

5 a. Explain the Q/R inventory system.  

A company needs 24,000 units/year of a certain component which will be used in its main product. The ordering cost is $150 per and the carrying cost per unit per year is 18% of the purchase price per unit. The purchase price per unit is $75. Find the economic order quantity.  

b. Demand for part number 1012 was 210 in January, 100 in February and 150 in March. The forecast for January was 140 units. With a smoothing constant of 0.30 and using first order exponential smoothing, what is the April forecast? Is 0.30 is a good choice as a smoothing constant?  

c. Define Quality. Discuss the two aspects of quality. Name some quality control tools and explain any one of them.