2015-2016
B.TECH WINTER EXAMINATION
(ELECTRONICS ENGINEERING)
EL-314-N
SEMICONDUCTOR DEVICE MODELING
CREDITS: 04

Maximum Marks: 60
Duration: Three Hours

Instructions:
1. Attempt all questions
2. Make appropriate assumptions if required
3. Symbols and abbreviations have their usual meanings.

Qs | Values of some constants: Energy gap for Si = 1.12 eV; Thermal voltage (kT/e = 25 mV at room Temp.); Permittivity of free space (ε₀ = 8.85×10⁻¹² F/m); Permittivity of silicon (εₘ = 12 ε₀); Permittivity of oxide (ε₀ₓ = 3.9 ε₀); Nᵥ = 1.04×10¹⁹ cm⁻³ | Marks
---|---|---
1(a) | What is the meaning of the Fermi-Dirac probability function? Show the curve of Fermi Dirac function showing the probability of a state being occupied and the probability of a state being empty. | 5
1(b) | Consider an infinitely large, homogeneous n-type semiconductor with zero applied electric field. Assume that at t = 0, a uniform concentration of excess carriers exists in the crystal under low level injection. Also, assume that g = 0 for t > 0. Calculate excess carrier concentration as a function of time for t > 0. | 5
1(c) | Explain why the mobility in a semiconductor depends on the doping density. What is the driving force, which causes diffusion? List three recombination-generation mechanisms. | 5

OR

1'(a) | A piece of germanium doped with 10×10¹⁶ cm⁻³ shallow donors is illuminated with light generating 10×10¹⁵ cm⁻³ excess electrons and holes. Calculate the quasi-Fermi energies relative to the intrinsic energy and compare it to the Fermi energy in the absence of illumination. | 5
1'(b) | What is a compensated semiconductor? Determine the values of thermal equilibrium concentration of electrons and holes for silicon at T = 300 K if the Fermi-Energy is 0.22 eV above the valence band energy. | 5
1'(c) | Derive the Einstein’s relation. | 5

Contd.....2.
2(a) Explain the following:
   - Depletion and diffusion capacitance.
   - Recombination and generation currents in pn junction diodes.
   - Breakdown mechanisms in pn junction.

2(b) Show that the junction capacitance in linearly graded pn junctions is proportional to $(V_b + V_n)^{-1}$.

2(c) What is the difference between rectifying contact and non-rectifying contact? Explain with energy band diagram.

   OR

   With sketches of energy band diagrams, explain straddling, staggered and broken-gap heterojunctions. What is electron affinity rule?

2' (a) Consider two p+n silicon junctions at $T = 300$ K, reverse biased at $V_R = 5V$. The impurity doping concentrations in junction A are $N_A = 10^{18}$ cm$^{-3}$ and $N_D = 10^{15}$ cm$^{-3}$ and those in junction B are $N_A = 10^{18}$ cm$^{-3}$ and $N_D = 10^{16}$ cm$^{-3}$. Calculate the ratio of following parameters for junction A to junction B: Depletion Width, Maximum Electric Field and junction capacitance per unit area.

3(a) If the emitter doping concentration is $N_E = 10^{18}$ cm$^{-3}$. Find the base doping concentration such that the emitter injection efficiency is $y = 0.9950$. Assume $X_E = 2X_B = 2 \mu m$.

3(b) Determine the minimum base width $X_B$ such that the base transport factor is $\alpha_T = 0.9980$ ($D_B = 10 cm/s$ and $\tau_B = 10^{-7}s$).

3(c) What are the advantages and disadvantages of Gummel-Poon model. Discuss it in detail.

4(a) For a MOS capacitor with n-type substrate: show the energy band diagram for accumulation, depletion, intrinsic and inversion region (assuming $V_{FB} = 0$).

4(b) Define surface potential and bulk potential. Derive the expression of threshold voltage of MOSFET.

4(c) What is the need of accurate MOSFET models? Describe the various circuit models available for MOSFETs. What are the second order effects present in MOSFETs?
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
CONTROL SYSTEMS
EL-321

Maximum Marks: 60
Credits: 04
Duration: Three Hours

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

Q.No. Question M.M.
1(a) Distinguish between:
   (i) Causal and non-causal control systems.
   (ii) Static and dynamic control systems.
   (iii) Autonomous and non-autonomous control systems. [03]
1(b) What are PID controllers? Indicate their effects on the system performance. [04]
   OR
1(b') A unity feedback system has an open loop transfer function:
   \[ G(s) = \frac{K}{(s + 1)^3(s + 4)} \] [04]
   Using Routh-Hurwitz criterion determine:
   (i) The range of \( K \) for the closed loop system’s stability;
   (ii) The frequency of oscillations when the system is marginally stable
1(c) For a feedback control system having its open-loop transfer function as:
   \[ G(s)H(s) = \frac{10(s + 10)}{s(s + 5)(s + 2)} \] [08]
   Draw the Bode’s plot and hence, find the gain crossover frequency, phase
crossover frequency, gain margin and phase margin. Comment on the stability of
the system.
   OR

Contd....2.
1(c') The open-loop transfer function of a feedback control system is:

\[ G(s)H(s) = \frac{K}{s(s + 3)(s^2 + 2s + 2)} \]

Draw the complete root locus and hence, determine the value of \( K \) for the damping ratio of 0.5

2(a) Write the properties of state transition matrix?

2(b) Define controllability and observability of a control system.

Test the controllability and observability of the system described by the following state equations:

\[
\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ -2 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} [u]
\]

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

2(c) Determine the transfer function of the system described by the following state equations:

\[
\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & -3 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix} [u]
\]

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

3(a) What is the significance of optimal control system?

3(b) Find the points in the three-dimensional euclidean space that extremize the function \( f(x_1, x_2, x_3) = x_1^2 + x_2^2 + x_3^2 \) and lie on the intersection of the surfaces

\[ x_3 = x_1 x_2 + 5 \]

\[ x_1 + x_2 + x_3 = 1 \]

3(c) For the given system described by the following state equation:

\[ \dot{x} = -x + u; \]

with boundary conditions \( x(0) = x^0, \ x(2) = x^1 \). Find \( u^* \) that minimizes the function \( J = \int_0^2 (x^2 + u^2) \, dt \).

4(a) What are the methods of analysis for nonlinear control systems?
4(b) Derive the describing function of the non-linearity whose characteristics is shown in Fig.1.

\[ N = \frac{4}{\pi} \angle 0^\circ \]

Fig.1

OR

4(b') For a unity feedback control system, if an ideal relay with an output equal to unity has its describing function as \( N = \frac{4}{\pi} \angle 0^\circ \), is operating in cascade with the linear system having \( G(s) = \frac{10}{s(s+1)(s+2)} \), in forward path. Determine the amplitude and frequency of the limit cycle, if it exists.
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
DIGITAL COMMUNICATION
EL-342

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) A pair of signals \( s_i(t) \) and \( s_k(t) \) have a common duration \( T \). Show that the inner product of this pair of signal is given by

\[
\int_{0}^{T} s_i(t)s_k(t)dt = s_i^*s_k
\]

where \( s_i \) and \( s_k \) are the vector representations of \( s_i(t) \) and \( s_k(t) \), respectively. Also, show that

\[
\int_{0}^{T} (s_i(t) - s_k(t))^2 dt = \| s_i - s_k \|^2
\]

[05]

1(b) A three level PAM system whose constellation is shown in Figure 1 is used to transmit the data. Determine the optimum threshold that minimizes the average probability of error and the probability of error.

Fig. 1

[10]

2(a) Consider a 4-ary ASK communication system with amplitudes \( \pm 3d/2 \) and \( \pm d/2 \). Assume that the symbols are equiprobable a priory. Determine the optimum threshold for detection of this signal in AWGN channel with noise PSD = \( N_0/2 \). Also determine the average probability of symbol error in terms of average SNR/bit.

[10]

OR

2(a') The signal vector \( s_1 \) and \( s_2 \) are used to represent binary symbols 1 and 0, respectively, in a coherent binary FSK system. In the presence of AWGN, the received vector is \( x \). The receiver computes the inner products \( <x, s_1> \) and \( <x, s_2> \) and decides in favour of symbol 1 when \( <x, s_1> \) is greater than \( <x, s_2> \). Compute

Contd.....2.
2(b) Consider a 4-PSK constellation with \( d_{\min} = \sqrt{2} \). What is the additional energy required to send one extra bit (8-PSK) while keeping the same minimum distance (and thus with the same bit error probability)?

3(a) A computer executes four instructions that are designed by the code words (00, 01, 10, 11). Assuming that the instructions are used independently with probabilities (1/2, 1/8, 1/8, 1/4), calculate the percentage by which the number of bits used for the instructions may be reduced by the use of an optimum source code. Construct a Huffman code to realize the reduction.

OR

3(a') Use the Lempel-Ziv algorithm to encode the following binary sequence:  
\[011101001100010110100\]

3(b) Consider a binary symmetric channel characterized by the transition probability \( p \). Determine the mutual information of the channel as a function of \( p \), the a priori probability of symbol 1 at the channel input.

OR

3(b') A black-and-white television picture may be viewed as consisting of approximately 3\( \times \)105 elements, each of which may occupy one of 10 distinct brightness levels with equal probability. Assume that the rate of transmission is 30 picture frames per second and the signal-to-noise-ratio is 30 dB. Using information capacity theorem, calculate the minimum bandwidth required to support the transmission of the resulting video signal.

3(c) For a (5, 1) repetition code, evaluate the syndrome \( \mathbf{s} \) for all possible single-error patterns.

4(a) Why is there a processing gain in spread spectrum system?

4(b) A recorded conversation is to be transmitted by a direct sequence spread spectrum (DSSS) system. Assume that the spectrum of the speech signal is band limited to 3 kHz and a 128-level quantizer is used. Find out the chip rate required to obtain a processing gain of 20 dB.

4(c) What are the merits and demerits of direct sequence spread spectrum over frequency hopping spread spectrum.
1(a) Is it necessary that the input sequence be stored in bit reversed order for in place computation of DFT? Give reasons of your answer.

(b) The input and output of a recursive system, respectively, are $x[n]$ and $y[n]$. The system is described by a linear constant coefficient difference equation. Under what auxiliary conditions the system will be linear, time invariant and causal if $x[n]=0$ for $n<4$?

(c) Write a MATLAB program to compute linear convolution of two sequences of length $N$ using fft and ifft functions.

(d) We want to implement the linear convolution of a 10,000-point sequence with an FIR impulse response that is 100 points long. The convolution is to be implemented by using DFTs and inverse DFTs of length 256.
   (i) If the overlap-save method is used, what is the minimum number of 256-point DFTs and the minimum number of 256-point inverse DFTs needed to implement the convolution for the entire 10,000-point sequence? Justify your answer.
   (ii) If the overlap-add method is used, what is the minimum number of 256-point DFTs and the minimum number of 256-point inverse DFTs needed to implement the convolution for the entire 10,000-point sequence? Justify your answer.
   (iii) For the same filter and impulse response length considered in (i) and (ii), compare the number of arithmetic operations (multiplications and additions) required in the overlap-save method, overlap-add method, and direct convolution.

OR

(d') Define short term Fourier transform (STFT). Which of the limitations of Fourier transform are eliminated by STFT? Illustrate and prove the following properties of

Contd.....2.
STFT:
(i) Linearity
(ii) Time shifting
(iii) Frequency shifting or modulation

2(a) How do you use the MATLAB function tf2zp?
(b) Consider a bilinear transformation

\[ s = \alpha \frac{1 - z^{-1}}{1 + z^{-1}}, \] where \( \alpha = 2\pi \times 10^3 \).

(i) To which value of \( z \), is the variable \( s = 2\pi \times 10^3 (1+j) \) mapped?
(ii) To which value of \( \omega \), is the analog frequency \( \Omega = 2\pi \times 10^3 \) mapped?

OR

(b') Let \( H(z) \) be a unstable system with \( H(z) = 1/(1 - 1.5z^{-1} - 3z^{-2}) \). Using a feedback system of the form \( G(z) = Kz^{-1} \) determine the value of \( K \), if any, that will stabilize the system.

(c) A linear time-invariant system is realized by the flow graph shown in Figure – 1
(i) Write the difference equation relating \( x[n] \) and \( y[n] \) for this flow graph.
(ii) What is the system function of the system?
(iii) In the realization of Figure – 1, how many real multiplications and real additions are required to compute each sample of the output? (Assume that \( x[n] \) is real, and assume that multiplication by 1 does not count in the total.)
(iv) The realization of Figure – 1, requires four storage registers (delay elements). Is it possible to reduce the number of storage registers by using a different structure? If so, draw the flow graph; if not, explain why the number of storage registers cannot be reduced.

3(a) How can you interpret the fractional delay in discrete time system?
(b) The frequency response of a linear phase FIR filter is given by

\[ H(e^{j\omega}) = e^{-j3\omega/2} \cos \frac{\omega}{2} (0.78679 \cos \omega - 0.313320). \]
Determine the filter coefficients \( h[n] \).

OR

(b') Consider the causal linear time invariant system, described by the transfer function 
\( H(z)=1-z^{-1} \).

(i) Show that \( H(z) \) has generalized linear phase by expressing the system’s
frequency response in the form 
\( H(e^{j\omega}) = A(e^{j\omega})e^{j\beta} \), where \( A(e^{j\omega}) \) is a real-valued function and \( \alpha \) and \( \beta \) are constants.

(ii) Determine which standard type of FIR generalized linear phase filter \( H(z) \) is:
type I, II, III or IV.

(c) The frequency response of an ideal band-pass filter is given by
\[
H(e^{j\omega}) = \begin{cases} 
0 & 0 \leq |\omega| < \pi/8 \\
1 & \pi/8 \leq |\omega| < 3\pi/8 \\
0 & 3\pi/8 \leq |\omega| < \pi 
\end{cases}
\]

(i) Show that the impulse response of the filter can be expressed as the product
of \( \cos(n\pi/4) \) and the impulse response of a low-pass filter.

(ii) Design a length-7 filter using Hann window.

4(a) What kind of signal processing operation is performed by the following MATLAB
program?

```matlab
x=[1 2 3 4 1 3 4 5 6 3];
up=upsample(x,2);
z=zeros(1,10);
for n=1:10;
    k=n+1;
    z(1,k)=up(1,n);
end
y=downsample(z,2,1);
```

(b) Consider the system show in the Figure 2. For the input signal, 
\( x[n] = \left[ \frac{\sin(m/8)}{m} \right]^2 \),
show that the output \( x_r[n] = x[n] \).
A second order system is described by the following difference equation
\[ y[n] = \frac{7}{8} y[n-1] - \frac{5}{8} y[n-2] + x[n] \]

(i) Is the system stable?
(ii) Let the input to the system is \( x[n] = \frac{1}{5} \delta[n] \) and the product of two numbers is rounded off to 4-bit signed fractions (i.e., 1 sign bit and 3 bits for magnitude). Discuss the behaviour of the system under above conditions. (Assume \( y[-1] = y[-2] = 0 \)).

OR

Show that the variance of the error in the frequency response, \( \sigma_e^2(\omega) \) of length \( N+1 \) FIR filter due to coefficient quantization (round off to \( b \)-bit magnitude) is bounded as:
\[ \sigma_e^2(\omega) \leq 2^{-2(b+4)} (2N + 1)/3 \]
Answer all the questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.       Question                                                                                     M.M.
1(a)       Hosts A and B are each connected to a switch S via 10-Mbps links as shown in Fig. 1. The propagation delay on each link is 20 μsec. S is a store and forward device; it begins transmitting a received packet 35 μsec after it has finished receiving it. Calculate the total time required to transmit 10000 bits from A to B. [03]

Fig. 1

OR

1(a)       Consider two hosts, Hosts A and B, connected by a single link having data rate of 56 kbps. Suppose that the two hosts are separated by \( m \) meters and propagation speed along the link is \( 2.5 \times 10^8 \) m/sec. Host A is to send a packet of size 100 bytes to Host B. Find propagation delay \( t_{\text{prop}} \) and transmission time \( t_{\text{trans}} \). Find the distance \( m \) so that at \( t = t_{\text{trans}} \) the recipient host B will just start receiving the first bit. [03]

1(b)       Show that 2-D parity code allows detection of all 3-bit errors. [03]

1(c)       Suppose the following sequence of bits arrive over the link:

\[
0110101111101010011111101110111111110
\]

Show the resulting frame after any stuffed bits have been removed. Indicate any errors that might have been introduced into the frame. [03]

OR

1(c)       Show that the Internet checksum will never be 0xFFFF (that is, the final value of [03]

Contd.....2.
sum will not be 0x0000) unless every byte in the buffer is 0.

1(d) Suppose that instead of Go-Back-N ARQ, N simultaneous Stop-and-Wait ARQ processes are run in parallel over the same transmission channel. Each SDU is assigned to one of the N processes that is currently idle. The processes that have frames to send take turns transmitting in round robin fashion. The frames carry the binary send sequence number as well as an ID identifying which ARQ process the frame belongs to. Acknowledgements for all ARQ processes are piggybacked onto every frame.

(i) Quantitatively, compare the relative performance of this protocol with Go-Back-N ARQ and with conventional Stop-and-Wait ARQ.

(ii) How does the service offered by this protocol differ from the service offered by Go-Back-N ARQ?

OR

1 (d) Find the optimal frame length $n_f$ that maximizes transmission efficiency of Stop-and-Wait ARQ for a channel with random bit errors.

2(a) What is the importance of delay-bandwidth product (DBWP) in designing a MAC protocol? Name two MAC protocols for which maximum throughput are independent of DBWP.

2(b) Let $G$ be the total rate at which frames are transmitted in a slotted ALOHA system. What proportion of slots go empty in this system? What portion of slots go empty when the system is operating at its maximum throughput.

2(e) With the help of suitable example, discuss how contention is resolved in CSMA/CD scheme. Show that the maximum throughput that can be achieved in a CSMA/CD scheme is $\frac{1}{1+6.44a}$, where $a$ is the normalized one-way delay bandwidth product.

OR

2'(a) Suppose that a LAN is to carry voice and packet data traffic. Discuss what provisions if any are required to handle the voice traffic in the reservation, polling, token ring, ALOHA and CSMA-CD environments. What changes if any are

Contd.....3.
required for the packet data traffic?

2'(b) Compare frame structures of IEEE 802.3 and IEEE802.11 LAN standards. Explain why four address fields are needed in IEEE 802.11 LAN, compared to only two address fields in Ethernet standards.

2'(c) Why is it that the Ethernet standard, which was designed for broadcast networks, is not used in wireless networks?

2'(d) Suppose N Ethernet stations, all trying to send at the same time, require N/2 slot times to sort out who transmits next. Assuming the average packet size is 5 slot times; find the available bandwidth as a function of N.

3(a) With the help of suitable example, explain how self-routing can be performed in a banayan switch structure.

3(b) What are the advantages and disadvantages of flooding routing? What mechanism is used to reduce the resource wastage in this algorithm?

OR

3(b') What are the similarities and differences between vehicular traffic and the network traffic?

3(c) What is cut-through packet switching? Compare minimum delay in cut-through packet switching and virtual packet switching.

3(e) For the network shown in Fig. 2, find the set of associated routing table for each node using any one of the shortest path routing algorithm. The links are labelled with relative costs;

![Diagram of a network with nodes A, B, C, D, E, and F, and links with distances labeled: A to B (8), B to C (1), C to D (2), C to E (6), D to E (2), E to F (1), and A to C (3).]

Fig. 2

Contd...4.
4(a) A university has 150 LANs and 100 hosts in each LAN. Suppose the university has one class B address. Design an appropriate subnet addressing scheme.

4(b) (i) Perform CIDR aggregation on the following /24 IP addresses:
        200.96.86.0/24; 200.96.87.0/24; 200.96.88.0/24; 200.96.89.0/24.
(ii) Abbreviate the following IPv6 addresses:
        0000:0000:0000:AF36:7328:0000:87AA:0398

4(c) Suppose a router receives an IP packet containing 600 data bytes and has to forward the packet to a network with maximum transmission unit of 200 bytes. Assume that the IP header is 20 bytes long. Show the fragments that the router creates and specify the relevant values in each fragment header (i.e., total length, fragment offset, and more bit).

4(d) Explain the process of tunnelling to interconnect islands IPv6 networks separated by IPv4 networks.
Assume data suitably, if required. Notations used have their usual meaning.

1(a) An old wooden bridge over a bay is in danger of collapse. The highway department is currently considering two alternatives to alleviate the situation and provide for expected increases in future traffic. One plan is a conventional steel bridge, and the other is a tunnel under the bay. The department is familiar with bridge construction and maintenance but has no experience with maintenance costs for tunnels. The following data has been developed for the bridge:

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Cost</td>
<td>$170000</td>
</tr>
<tr>
<td>Painting every 6 years</td>
<td>$10000</td>
</tr>
<tr>
<td>Deck resurfacing every 8 years</td>
<td>$30000</td>
</tr>
<tr>
<td>Structural overhaul at the end of 12 years</td>
<td>$40000</td>
</tr>
<tr>
<td>Annual maintenance</td>
<td>$3000</td>
</tr>
</tbody>
</table>

The tunnel is expected to cost $240000 and will require repaving every 8 years at a cost of $20000. Both designs are expected to last 20 years with negligible salvage value. Since the tunnel under bay would require less supervision it would be preferred by the highway department. Determine the additional equivalent annual amount, if any, for maintenance that could be permitted for the tunnel if the present worth for both the alternatives is same. (i=8% per annum)

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

OR

1'(a) A machine was purchased 5 years ago for Rs. 100000. Its annual maintenance expense has been Rs. 5000 per year. At the end of three years, Rs. 9000 were spent on maintenance. At the end of five years (now), the machine is sold for Rs. 120000. During the period of ownership the machine was rented for Rs. 10000 per year paid at the beginning of each year. Find the Annual Worth of this investment when the interest rate is 12% per year.

Contd.....2.
17(b) Consider the following cash flow series. What value of C makes the deposit series equivalent to the withdrawal series at an interest rate of 12% compounded annually?

<table>
<thead>
<tr>
<th>EOY</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposits (in $)</td>
<td>1000</td>
<td>800</td>
<td>600</td>
<td>400</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Withdrawals (in $)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>2C</td>
<td>3C</td>
<td>4C</td>
<td>5C</td>
<td>6C</td>
</tr>
</tbody>
</table>

2(a) 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?

<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>

2(b) An asset for drilling was purchased and placed in service by a petroleum production company. Its cost Basis is Rs 60000 and it has an estimated Market value of Rs, 12000 at the end of an estimated useful life of 14 years. Compute the depreciation amount in the third year and the Book Value at the end of the Fifth year by using (i) Straight line method (ii) Double Declining Balance Method.

3(a) Differentiate the working of managers by level and area in an organization.

3(b) What are the three basic areas of concern for managerial ethics? Explain.

3(c) Explain the different decision making environments with suitable examples.

4(a) Define “Control” as a function of management and explain its purpose.

4(b) Describe the Managerial Grid and explain the different kind of leadership styles.

4(c) Define Motivation and explain Hertzberg’s theory of motivation.

OR

Contd......3.
4'(a) Differentiate between the following:
   (i) Power and authority
   (ii) Hierarchy and chain of commands
4'(b) Differentiate between strategic and operational plans with suitable examples.
4'(c) What is the need for coordination? What are its different forms? Explain any one.

5(a) Derive an expression for economic order quantity. Explain the various costs considered in the model.
5(b) Differentiate between income statement and balance sheet. Define any two financial ratios.
5(c) What is internationalization of an organization? Explain any two alternatives.