ACAD-27 a)	Shri Ramdeobaba College of Engineering and Management,Nagpur -440013	Iss. No.: 01, Rev. No.: 00
Ref. Clause(s): 9.1		Date of Rev: 01/01/2018
Department: **EC**	Semester : **III Section**: **A & B** Course Code: **ECT253** Course Name: **Signals and Systems**	Page: 01/01
Programme: **BE (EC)**	**Class Test: 1**	Date of Exam: **30-12-2021**
Max Marks: 15	**Session: 2021-22**	**Time: (1 Hr) 11.00 -12.00 noon**

Instructions:

1. All the questions are compulsory. Question Paper Consists of Two Pages.
2. Paper is to be solved using Pen and Paper Compulsorily. **Student must write the Name, Roll No. and Section on top of each sheet of paper** he/she is writing the answers.
3. At the end of the exam **Single pdf of handwritten answers** is to be uploaded by the student in Google Classroom and Turn-in.

Question No.	Questions	Marks	CO	EO
1	**Given,** $x(t) = \begin{cases} (t+1), & -1 \le t \le 0 \\ 1, & 0 < t \le 2 \\ (-t+3), & 2 < t \le 3 \\ 0, & Otherwise \end{cases}$ **Sketch the following signals** **a)** $x(t)$ **b)** $x\left(\frac{1}{3}t+1\right)$	2	CO1	L4
2	**Sketch the following Signals** **a)** $x(t) = r(t) - r(t-1) - u(t-4)$ **b)** $x(t) = r(t)\,u(3-t)$	2	CO1	L3
3	**a) Compute the energy of the following signal** $x(t) = \cos(10\pi t)\,u(t)\,u(2-t)$ **b) Compute the RMS value of the following signals** $x(t) = e^{jat}\cos(\omega t)$ **c) Find the fundamental period of the following signal** $x(t) = 2\sin(3t+1) + 3\sin(4t-1)$	3	CO1	L4
4	**Check whether the following system is Linear/Non-Linear and Time-invariant/Time-variant** $y(t) = x(t)\cos(\omega t)$	2	CO1	L2

5	**a) The input, impulse response and the output of DT-LTI system are given as $x[n] = \{1, \underset{\uparrow}{2}, 5\}$; $h[n] = \{1, \underset{\uparrow}{X}, 3\}$; and $y[n] = \{1, 4, \underset{\uparrow}{12}, 16, 15\}$ respectively. Find the value of X.** **b) Compute $y[n] = x[n] * h[n]$, where** **$x[n] = u[n] - u[n-3]$** **$h[n] = \delta[n] + 2\delta[n-1] + 3\delta[n-2]$**	**2** **2**	**CO1** **CO1**	**L2** **L2**
6	**The impulse response of the LTI Systems are given below. Determine whether the system is causal and stable.** **a) $h(n) = (2)^n\, u(3-n)$** **b) $h(t) = e^{2t}\, u(t+50)$**	**2**	**CO4**	**L5**

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Department: EC	**Semester : III** **Shift: I and II** **Course Code: ECT252** **Course Name: Digital System Design**	**Page: 01/01**
Programme: BE	**Test: 1 / ~~2~~**	**Date of Exam: 29/12/2021**
Max Marks: 15	**Session: 2021-22**	**Time: 1 hour**

Instruction: **Questions carry marks as indicated.**

Question No.	Questions	Marks	CO	EO
1	Design a digital circuit using 4-variable K-Map which will give an output as "logic 1" if the input is prime as well as odd.	8	CO2	L5
2	Solve the following using k-map. $\mathbf{f(A,B,C,D) = \prod M(0,2,8,9,10).D(5,12,13,14,15)}$ **OR** Design the following circuit using Verilog. Also draw its RTL schematic. Y = (AB'+CD) ⊕ (ABC)	7 7	CO1 CO1, CO2	L3 L5

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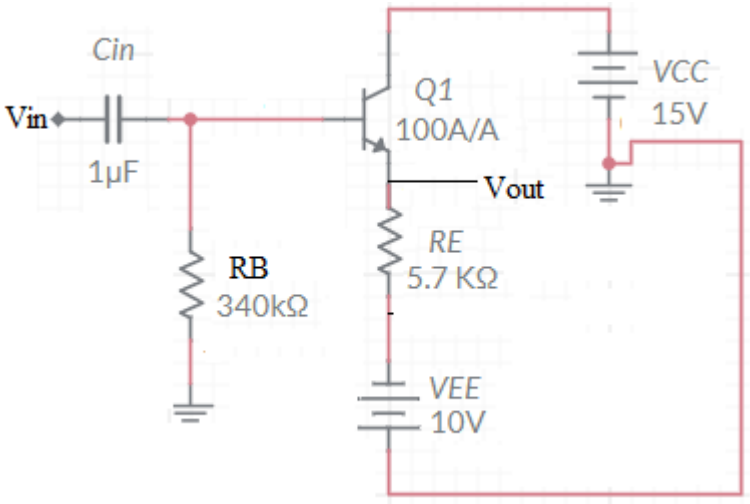
Ref. Clause(s): 9.1		**Date of Rev: 01/01/2018**
Department: EC	**Semester: III Section A & B** **Course Code: ECT 251** **Course Name: Electronic Devices**	**Page: 01/01**
Programme: BE	**Test:2**	**Date of Exam: 18/02/2022**
Max Marks: 15	**Session: 2021-22**	**Time: 2 pm - 3 pm**

Course outcomes

At the end of this course students will demonstrate the ability to
1. Summarize fundamentals of diodes and transistors.
2. Understand fundamentals of MOS technology and its properties.
3. Explain digital circuits using CMOS logic.
4. Apply biasing techniques to the amplifiers.
5. Analyze low frequency behaviour of BJT amplifiers.

Instructions: All questions are compulsory. Assume suitable data if required. Explain the answers with relevant figures wherever needed.

Question No.	Questions	Marks	CO	EO
1	Design a fixed biased circuit using a silicon transistor having $\beta = 100$. $VCC = 10\ V$ and dc conditions are to be $VCE = 5\ V$ and $IC = 5\ mA$.	3	4	L5
2	Transistor used in the circuit is silicon type Q1 (100A/A). Evaluate current gain AI, and voltage gain AV. Assume *hfe* = 75, *hie = 4.37 KΩ, hoe = hre = 0.* 	3	5	L4
3	A n- channel and p- channel JFET devices are available in the laboratory for an amplifier design. Which one will you prefer so as to have better speed of operation and why?	3	1	L3
4	What do you mean by body effect in MOSFET devices?	3	2	L1
5	Realize the following function using CMOS logic. $F = \overline{(A.(\overline{B.(C+D)}))}$	3	3	L5

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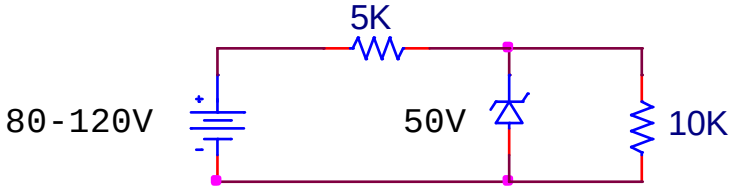
Department: EC	**Semester: III Section A & B** **Course Code: ECT251** **Course Name: Electronics Devices**	**Page: 01/01**
Programme: BE	**Test:1**	**Date of Exam: 31/12/2021**
Max Marks: 15	**Session: 2021-22**	**Time: 2 pm - 3 pm**

Course outcomes

At the end of this course students will demonstrate the ability to

1. Summarize fundamentals of diodes and transistors.
2. Understand fundamentals of MOS technology and its properties.
3. Explain digital circuits using CMOS logic.
4. Apply biasing techniques to the amplifiers.
5. Analyze low frequency behaviour of BJT amplifiers.

Instructions: All questions are compulsory. Assume suitable data wherever needed.

Question No.	Questions	Marks	CO	EO
1	Analyze the circuit of Full wave bridge rectifier.	4	1	L4
2	 For the above circuit, Evaluate the maximum and minimum values of Zener diode current.	4	1	L5
3	Estimate the collector current and emitter current of a transistor with $\alpha = 0.99$ and $I_{CEO} = 100\ \mu A$ when the base current is $10\ \mu A$.	4	1	L3
4	Illustrates Current Components in BJT with neat diagram.	3	1	L3

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Ref. Clause(s): 9.1		Date of Rev: 01/01/2018
Department: **EC**	Semester : **IV** Section: **A & B** Course Code: **ECT259** Course: **Probability Theory & Stochastic Processes**	Page: 01/01
Programme: **BE (EC)**	**Class Test: 1**	Date of Exam: **20-05-2022**
Max Marks: 15	**Session: 2021-22**	Time: (1 Hr) **11.00 am-12.00 noon**

Que No.	Questions	Marks	CO	EO
Q. 1	A town has two doctors X and Y operating independently. If the probability that doctor X is available is 0.9 and that for Y is 0.8, what is the probability that at least one doctor is available when needed? = 0.98	2	CO1	L2
Q. 2	The odds that a movie will be favourably reviewed by three independent critics are 5 to 2, 4 to 3 and 3 to 4 respectively. What is the probability that of the three reviews, a majority will be favourable? $= \frac{209}{343} = 0.6093$	2	CO1	L2
Q. 3	The chances of A, B and C becoming the General Manager of a company are in the ratio **4 : 2 : 3**. The probabilities that the bonus scheme will be introduced in the company if A, B and C become General Manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is the probability that A has been appointed as General Manager? = 6/25 = 0.24	4	CO5	L4
Q. 4	A R.V. X has the PDF $f(x) = \begin{cases} 2x, & 0 < x < 1 \\ 0, & otherwise \end{cases}$ Compute i) E[X] $= \frac{2}{3}$ ii) $P\left(X > \frac{3}{4} / X > \frac{1}{2}\right) = 7/12 = 0.5833$	2	CO5	L3
Q. 5	If X and Y are two random variables with joint PMF as $P(x,y) = k\,(2x + 3y), \quad x = 0,1,2. \ and \ y = 1,2,3.$ Evaluate the marginal and conditional distributions for a) $P(X = 2, Y \leq 2) = 17/72 = 0.2361$ b) $P(X \leq 1 / Y \leq 2) = 22/39 = 0.5641$ c) $P(X = 0 / Y = 2) = 1/4 = 0.25$	3	CO5	L5
Q. 6	The probability of man hitting a target is $\frac{1}{4}$. Deduce the probability of hitting the target exactly twice, if he fires 7 times. = 0.31146	2	CO5	L3

Q.1 $P(\text{at least 1 available}) = P(X)\cdot P(\bar{Y}) + P(\bar{X})P(Y) + P(X)P(Y)$

$= 0.9\times0.2 + 0.1\times0.8 + 0.8\times0.9$

$= 0.98 = 1 - P(\bar{X})\cdot P(\bar{Y})$

Q.2 $P(A)=\frac{5}{7}$, $P(B)=\frac{4}{7}$, $P(C)=\frac{3}{7}$

$P(\bar{A})=\frac{2}{7}$, $P(\bar{B})=\frac{3}{7}$, $P(\bar{C})=\frac{4}{7}$

$\therefore$ Req prob $= P(A)P(B)P(\bar{C}) + P(A)P(\bar{B})P(C) + P(\bar{A})P(B)P(C) + P(A)P(B)P(C)$

$= \frac{5}{7}\frac{4}{7}\frac{4}{7} + \frac{5}{7}\cdot\frac{3}{7}\frac{3}{7} + \frac{2}{7}\frac{4}{7}\frac{3}{7} + \frac{5}{7}\cdot\frac{4}{7}\frac{3}{7} = \frac{209}{343}$

Q.3 No. of possible cases $4+2+3=9$.

$P(A)=\frac{4}{9}$, $P(B)=\frac{2}{9}$, $P(C)=\frac{3}{9}$, $P(A)+P(B)+P(C)=1$

Let D = event that Bonus scheme has been introduced.

$P(D/A)=0.3$, $P(D/B)=0.7$, $P(D/C)=0.8$.

$\therefore P(D) = P(A)\cdot P(D/A) + P(B)\cdot P(D/B) + P(C)\cdot P(D/C)$

$= \frac{4}{9}\cdot0.3 + \frac{2}{9}\cdot0.7 + \frac{3}{9}\cdot0.8 = \frac{5}{9}$

$\therefore P\left(\begin{matrix}A \text{ has been appointed as G.M.}\\ \text{Given that Bonus scheme has been introduced.}\end{matrix}\right) = P(A/D) = \frac{P(A)\cdot P(D/A)}{P(D)}$

$= \frac{\frac{4}{9}\times0.3}{5/9} = \frac{1.2}{5} = \frac{6}{25}$

Q.4 i] $E[X] = \int_0^1 x\cdot f(x)\,dx = \int_0^1 x\cdot(2x)\,dx = 2\cdot\left[\frac{x^3}{3}\right]_0^1 = \frac{2}{3}$

ii] $P\left(X>\frac{3}{4}/X>\frac{1}{2}\right) = \frac{P(X>\frac{3}{4})\cap P(X>\frac{1}{2})}{P(X>\frac{1}{2})} = \frac{P(X>\frac{3}{4})}{P(X>\frac{1}{2})} = \frac{\int_{3/4}^1 2x\,dx}{\int_{1/2}^1 2x\,dx} = \frac{1-(0.75)^2}{1-(0.5)^2} = \frac{0.4375}{0.75}$

$= \frac{7/16}{3/4} = \frac{7}{12} = 0.5833$

Q.5

X \ Y	1	2	3	
0	3k	6k	9k	18k $\Rightarrow P(X=0)$
1	5k	8k	11k	24k $\Rightarrow P(X=1)$
2	7k	10k	13k	30k $\Rightarrow P(X=2)$
	15k	24k	33k	(72k)
	P(Y=1)	P(Y=2)	P(Y=3)	

$72k=1 \Rightarrow k=\frac{1}{72}$

i] $P(X=2, Y\le2) = 7k+10k = \frac{17}{72}$

ii] $P(X\le1/Y\le2) = \frac{P(X\le1, Y\le2)}{P(Y\le2)} = \frac{22k}{39k} = \frac{22}{39}$

iii] $P(X=0/Y=2) = \frac{P(X=0, Y=2)}{P(Y=2)} = \frac{6k}{24k} = \frac{1}{4}$

Q.6 $p=\frac{1}{4}$, $q=\frac{3}{4}$ $\Rightarrow {}^nC_k\cdot p^k\cdot q^{(n-k)}$

$P(X=2) = {}^7C_2\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^5$

$= 0.31146$

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Department: **EC**	Semester : **III Section**: **A & B** Course Code: **ECT253** Course Name: **Signals and Systems**	Page: 01/01
Programme: **BE (EC)**	**Class Test: 2**	Date of Exam: **17-02-2022**
Max Marks: 15	**Session: 2021-22**	**Time: (1 Hr) 11.00 -12.00 noon**

Instructions:

1. All the questions are compulsory.
2. Paper is to be solved using Pen and Paper Compulsorily. **Student must write the Name, Roll No. and Section on top of each sheet of paper** he/she is writing the answers.
3. At the end of the exam **Single pdf of handwritten answers** is to be uploaded by the student in Google Classroom and **Turn-in**.

Question No.	Questions	Marks	CO	EO
Q. 1	CT-LTI system is described as $\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} + 30y(t) = x(t) + \frac{dx(t)}{dt}$ Determine the impulse response $h(t)$ if the system is both stable and causal.	**3**	**CO2, CO4**	**L3**
Q. 2	CT-LTI system is described as $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$ Obtain the transfer function of the system and Draw its Pole – Zero diagram.	**2**	**CO2, CO4**	**L2**
Q. 3	Find the impulse response $h[n]$ of the system described by the difference equation $y[n] - 4\,y[n-1] + 3\,y[n-2] = x[n] + 2\,x[n-1]$ using z-transform.	**4**	**CO3**	**L4**
Q. 4	A causal LTI system is observed to produce an output $y(t) = (e^{-4t} - e^{-5t})\,u(t)$ for the input $x(t) = e^{-5t}\,u(t)$. Obtain the Frequency response of this system. Plot its Magnitude and Phase Spectrum.	**4**	**CO5**	**L5**
Q. 5	i. Compute DTFT of the signal $x[n] = \delta[n+2] - \delta[n-2]$	**1**	**CO5**	**L2**
	ii. Deduce Inverse DTFT of the following $X(j\omega) = 1 - e^{-j\omega} + 2e^{-j2\omega} + 2e^{-j3\omega}$	**1**	**CO1**	**L3**

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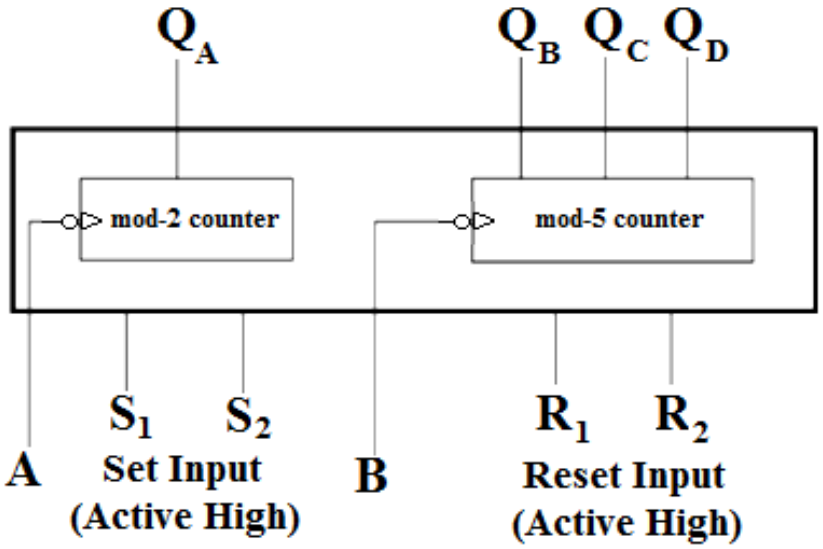
Ref. Clause(s): 9.1		**Date of Rev: 01/01/2018**
Department: EC	**Semester : III** **Shift: I and II** **Course Code: ECT252** **Course Name: Digital System Design**	**Page: 01/01**
Programme: BE	**Test: 2**	**Date of Exam: 16/02/2022**
Max Marks: 15	**Session: 2021-22**	**Time: 1 hour**

Instruction: **Questions carry marks as indicated.**

Question No.	Questions	Marks	CO	EO
1	Write a Verilog code for a digital circuit described by the functional block diagram given below.  Q_A, Q_B, Q_C, Q_D are the outputs. A and B are the inputs. Additionally, S_1, S_2 are set inputs and R_1, R_2 are reset inputs of mod-2 and mod-5 counters respectively. Output Q_A can be connected externally with input B cascading the two counters. Make a provision for cascading the two counters internally depending on an additional input C.	10	CO2	L6
2	Implement the half adder using PAL and PLA. **OR** Explain Totem Pole Logic of TTL NAND gate with diagram.	05 05	CO2 CO3 CO4	L2 L2

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Ref. Clause(s): 9.1		**Date of Rev: 01/01/2018**
Department: EC	**Semester : III** **Shift: I & II** **Course Code: MAT-255** **Course Name: Mathematics-III**	**Page: 01/01**
Programme: BE	**Test: 1**	**Date of Exam: 29/12/2021**
Max Marks: 15	**Session: 2020-21**	**Time: 1 Hr.**

Instructions: All the questions are compulsory.

Question No.	Questions	Marks	CO	EO
1	Given that $L\left[\sin\sqrt{t}\right] = \frac{\sqrt{\pi}}{2s^{3/2}}e^{-1/4s}$ prove that, $L\left[\frac{\cos\sqrt{t}}{\sqrt{t}}\right] = \left(\frac{\pi}{s}\right)^{1/2} e^{-1/4s}$.	3	CO3	
2	Show that the Laplace transform of square wave, $f(t) = \begin{cases} k, 0 < t < a \\ -k, a < t < 2a \end{cases}$, T = 2a is $F(s) = \frac{k}{s}\tanh\left(\frac{as}{2}\right)$.	4	CO3	
3	The initial value problem governing the current $'i'$ flowing in series R-L circuit when a voltage $'t'$ is applied is given by, $iR + L\frac{di}{dt} = t; t \geq 0; i(0) = 0$ where R and L are constants. Find the current at any time t using Laplace transform.	4	CO3	
4	Find $Z-$transform of the following sequences a) $f_n = \begin{cases} 2, & n = 0, 2, 4, \ldots\ldots, 2k, \ldots \\ 1, & n = 1, 3, 5, \ldots\ldots, 2k+1, \ldots \end{cases}$ b) $f_n = e^{(n-2)}$	4	CO3	

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Ref. Clause(s): 9.1		**Date of Rev: 01/01/2018**
Department: EC	**Semester : III Shift: I & II** **Course Code: MAT-255** **Course Name: Mathematics-III**	**Page: 01/01**
Programme: BE	**Test: II**	**Date of Exam: 16/02/2022**
Max Marks: 15	**Session: 2021-22**	**Time: 1 Hr.**

Instructions: All the questions are compulsory.
Use of non-programmable calculators is allowed

Question No.	Questions	Marks	CO
1	a) Solve the difference equation using Z-transform $y_{n+2} - 3y_{n+1} + 2y_n = 0,\ y_0 = -1, y_1 = 2.$	3	CO3
2	Find the general solution of the partial differential equation $(x + y^2)p + yq = z + x^2.$	3	CO1
3	Find the general solution of given partial differential equation $2\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = \sin(x - 2y)$	3	CO1
4	a) Using Cauchy-Riemann equations, show that $\lvert z\rvert^2$ and $\bar{z}$ are not analytic at any point. b) If $f(z)$ is analytic in a domain D and $\lvert f(z)\rvert$ is a non-zero constant in D, then show that $f(z)$ is constant in D.	3 3	CO2