K. J. Somaiya Institute of Engineering and Information Technology
Sion, Mumbai - 400022
NAAC Accredited Institute with 'A' Grade
NBA Accredited 3 Programs
(Computer Engineering, Electronics & Telecommunication Engineering and Electronics Engineering)
Permanently Affiliated to University of Mumbai

EXAMINATION TIME TABLE (JANUARY 2021)

PROGRAMME - T.E. (Electronics) (REV. -2012)(CBSGS)

SEMESTER - V

Days and Dates	Time	Course Code	Paper
Thursday, January 7, 2021	3.30 p.m to 5.30 p.m	EXC501	MICROCONTROLLERS AND APPLICATIONS
Saturday, January 9, 2021	3.30 p.m to 5.30 p.m	EXC502	DESIGN WITH LINEAR INTEGRATED CIRCUITS
Tuesday, January 12, 2021	3.30 p.m to 5.30 p.m	EXC503	ELECTROMAGNETIC ENGINEERING
Thursday, January 14, 2021	3.30 p.m to 5.30 p.m	EXC504	SIGNALS & SYSTEMS
Saturday, January 16, 2021	3.30 p.m to 5.30 p.m	EXC505	DIGITAL COMMUNICATION

Important Note: ● **Change if any, in the time table shall be communicated on the college web site.**

Mumbai
20th December 2020

PRINCIPAL

University of Mumbai
Examination 2020 under Cluster 06
(Lead College: Vidyavardhini's College of Engg Tech)

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev2012

Examination: TE Semester V

Course Code: **EXC501** and Course Name: **Microcontrollers and Applications**

Time: 2 hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	In 8051 Microcontroller, what is time period of 1 machine cycle if crystal frequency is 11.0592 MHz?
Option A:	1µs
Option B:	2µs
Option C:	1.085µs
Option D:	11.0592 MHz
2.	What is the starting and ending location of internal ROM for 8051 Microcontroller?
Option A:	00 to FFH
Option B:	00 to 7FH
Option C:	0000H to FFFFH
Option D:	0000H to 0FFFH
3.	In 8051, following flags are used to select register bank 0 to 3.
Option A:	Carry flag
Option B:	Overflow flag
Option C:	RS0 & RS1 flags
Option D:	Parity flag
4.	Following instruction belongs to Direct addressing mode.
Option A:	MOV DPTR, #5000H
Option B:	ADD R2, 40H
Option C:	SWAP A
Option D:	MUL AB

5.	What is the content of accumulator after execution of following program?
	MOV A, #8DH
	ADD A, #00H
	DA A

Option A:	93H
Option B:	8DH
Option C:	00H
Option D:	FFH

6.	Following is not a part of the executable program in 8051 Microcontroller.
Option A:	MOV
Option B:	ADD
Option C:	SUB
Option D:	END
7.	Following instruction is not VALID in 8051 Microcontroller.
Option A:	MOV A, R0
Option B:	DEC DPTR
Option C:	MOV A, @R1
Option D:	MOV A, #30H
8.	What is the instruction to copy content of external RAM location to 8051 Microcontroller?
Option A:	MOV A, @R0
Option B:	MOVX A, @DPTR
Option C:	MOV A, DPTR
Option D:	MOV A, 5000H
9.	In 8051 Microcontroller, which instruction belongs to Read-Modify-Write instruction?
Option A:	MOV A, P0
Option B:	MOV P0, A
Option C:	MOV P0, 0FH
Option D:	ANL P1,A
10.	Which port of 8051 Microcontroller is having alternate functions like RD', WR', etc?
Option A:	P0
Option B:	P1
Option C:	P2
Option D:	P3
11.	Which driver IC is used for stepper motor interfaced with 8051?
Option A:	ULN2003
Option B:	L293D
Option C:	Decoder
Option D:	Encoder
12.	If baud rate is 9600 for serial communication, what is the value of count to be loaded ?
Option A:	FDH
Option B:	FFH
Option C:	00H
Option D:	FCH
13.	In 8051, which flags are used to indicate that serial communication (Reception or Transmission) is over?
Option A:	Carry & Zero
Option B:	RB8 & TB8
Option C:	RI & TI

Option D:	RS0 & RS1
14.	While programming, what should be the content of SOC (start of conversion) pin of ADC 0809?
Option A:	Low to High
Option B:	High to Low
Option C:	Always High
Option D:	Always Low
15.	In RISC architecture, length of every instruction is _____.
Option A:	16-bit
Option B:	variable
Option C:	fixed i.e. 32-bit
Option D:	8-bit
16.	ARM7TDMI processor consist of total _____ 32-bit registers.
Option A:	14
Option B:	20
Option C:	37
Option D:	10
17.	ARM7TDMI supports _____ exceptions/interrupts.
Option A:	1
Option B:	3
Option C:	5
Option D:	6
18.	Following instruction is an example of Arithmetic shift right for ARM7TDMI.
Option A:	MOV R0, R1, LSL #2
Option B:	MOV R0, R1, LSR R2
Option C:	MOV R0, R1, ASR #2
Option D:	MOV R0, R1, ROR R2
19.	What is the instruction to get 1's compliment of number 02H in register R0 for ARM7TDMI?
Option A:	MVN R0, #2
Option B:	MOV R0, #2
Option C:	TEQ R0, #2
Option D:	LDR R0, [R1], R2, LSL # 2
20.	ARM7TDMI consist of _____ conditional flags in CPSR.
Option A:	1
Option B:	2
Option C:	3
Option D:	4

Q2.	**Solve any Four out of Six** **5 marks each Total 20 Marks**
A	Explain Flag register of 8051 microcontroller in detail.
B	Draw & Explain internal structure of Port 0 for 8051 Microcontroller.

C	Explain significance of letters and numbers in – 'ARM7TDMI'.
D	Draw & Explain CPSR of ARM7TDMI.
E	Write a short note on exceptions of ARM7TDMI.
F	Explain following ARM7TDMI architecture based instructions with example. a) BL b) ADD c) LDR

Q3.	**Solve any Two questions out of Three** **10 marks each** **Total 20 Marks**
A	Explain following instructions of 8051 Microcontroller with example. (a) LCALL (b) MOVX (c) MUL (d) CJNE (e) DJNZ
B	Explain various Timer modes available in 8051 microcontroller in detail.
C	Draw & Explain programmer's model (register structure) of ARM7TDMI.

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Program: **Electronics Engineering**

Curriculum Scheme: Rev2012

Examination: TE Semester V

Course Code: **EXC501** and Course Name: **Microcontrollers and Applications**

Time: 2 hour Max. Marks: 80

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Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	C
Q2.	D
Q3.	C
Q4	B
Q5	A
Q6	D
Q7	B
Q8.	B
Q9.	D
Q10.	D
Q11.	A
Q12.	A
Q13.	C
Q14.	B
Q15.	C
Q16.	C
Q17.	C
Q18.	C
Q19.	A
Q20.	D

University of Mumbai
Examination 2020 under Cluster 06
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Examinations Commencing from 07th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2012

Examination: TE Semester V

Course Code: **EXC502** and Course Name: **Design with Linear Integrated Circuit**

Time: 2 hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which of the following stage is used as a level shifter stage in op-amp?
Option A:	Common Collector
Option B:	Common Emitter
Option C:	Common Base
Option D:	Common Gate
2.	An ideal operational amplifier has _____
Option A:	zero input resistance
Option B:	infinite output resistance
Option C:	infinite input resistance
Option D:	zero bandwidth
3.	Opamp can be used as a logarithmic amplifier by replacing _____of inverting amplifier by _____
Option A:	feedback resistor, diode
Option B:	feedback resistor, capacitor
Option C:	input resistor, diode
Option D:	input resistor, capacitor
4.	Wien bridge oscillator is a_____oscillator
Option A:	low frequency
Option B:	high frequency
Option C:	ultra high frequency
Option D:	fixed 50kHz frequency
5.	The ideal differentiator will have a frequency response like a _____
Option A:	Low pass filter
Option B:	High pass filter
Option C:	Band pass filter
Option D:	Band reject filter
6.	In Schmitt trigger, the hysteresis voltage is given by the _____ upper & lower threshold voltages (V_{UT} & V_{LT} respectively).
Option A:	sum of
Option B:	difference of

Option C:	product of
Option D:	division of
7.	The nature of output waveform of Schmitt trigger is like _____
Option A:	triangular wave
Option B:	saw tooth wave
Option C:	square wave
Option D:	sinusoidal wave
8.	A window comparator is a circuit which _____
Option A:	has only one usable threshold
Option B:	uses hysteresis to speed up response
Option C:	clamps the input positively
Option D:	Detects an input voltage between two limits
9.	Which of the following statement is true for active/passive filters?
Option A:	Passive filters provide gain
Option B:	Passive filters use BJT
Option C:	Active filters are costlier
Option D:	Active filters provide gain
10.	In sample and hold circuit, which component is used to hold the input signal peak value?
Option A:	Diode
Option B:	Inductor
Option C:	Capacitor
Option D:	MOSFET switch
11.	The advantage(s) of instrumentation amplifier over normal subtractor is _____
Option A:	higher gain and higher input resistance
Option B:	lower gain and higher input resistance
Option C:	lower input resistance
Option D:	low slew rate
12.	In second order low pass filter, gain in the stop band _____
Option A:	decreases by 20dB/dec
Option B:	decreases by 40dB/dec
Option C:	increases by 20dB/dec
Option D:	increases by 40dB/dec
13.	Which of the following is considered as a fastest ADC?
Option A:	Servo converter
Option B:	Counter type ADC
Option C:	Flash type ADC
Option D:	Successive approximation type ADC
14.	How many number of stable states IC 555 based monostable multivibrator has?
Option A:	0
Option B:	1
Option C:	2

Option D:	3
15.	The major advantage of the R/2R ladder digital-to-analog converter(DAC) compared to a binary-weighted type digital-to-analog DAC converter is _____
Option A:	It uses only two different values for resistors
Option B:	It has fewer parts for the same number of inputs
Option C:	Its operation is much easier to analyze
Option D:	The virtual ground is eliminated and the circuit is therefore easier to understand and troubleshoot
16.	Which type of Flip Flop is present inside IC 555 timer?
Option A:	JK Flip Flop
Option B:	T Flip Flop
Option C:	D Flip Flop
Option D:	SR Flip Flop
17.	The output of phase detector in PLL is a _____
Option A:	Triangular wave
Option B:	Square wave
Option C:	DC voltage
Option D:	Sinusoidal voltage
18.	The output voltage of IC7905 voltage regulator typically is_____
Option A:	5V
Option B:	-5V
Option C:	12V
Option D:	-12V
19.	Which regulator among the following is not categorized as a linear voltage regulator?
Option A:	Fixed output voltage regulator
Option B:	Adjustable output voltage regulator
Option C:	Switching regulator
Option D:	Special regulator
20.	The typical dropout voltage for the IC78XX series voltage regulator is_____
Option A:	10mV
Option B:	2V
Option C:	20V
Option D:	0.6V

Q2 **(20 Marks)**	
A	**Solve any Two** **5 marks each**
i.	Draw and explain the block diagram of op-amp
ii.	Explain op-amp as a subtractor
iii.	Design a monostable multivibrator to get output pulse width of 10msec
B	**Solve any One** **10 marks each**
i.	Design a first order low pass filter at cut-off frequency 1KHz with a pass band gain of 2
ii.	What is precision rectifier? Explain full wave precision rectifier using op-amp

Q3 **(20 Marks)**	
A	**Solve any Two** **5 marks each**
i.	Write a short note on Successive Approximation type Analog to Digital Converter
ii.	Explain zero crossing detector using op-amp
iii.	Design a current source of 0.5Amp using IC7805
B	**Solve any One** **10 marks each**
i.	Explain IC 723 with the help of functional block diagram
ii.	Design an astable multivibrator to get output rectangular wave with 60% duty cycle at 2kHz frequency

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Examination Commencing from 07th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2012

Examination: TE Semester V

Course Code: **EXC502** and Course Name: **Design with Linear Integrated Circuit**

Time: 2 hour Max. Marks: 80

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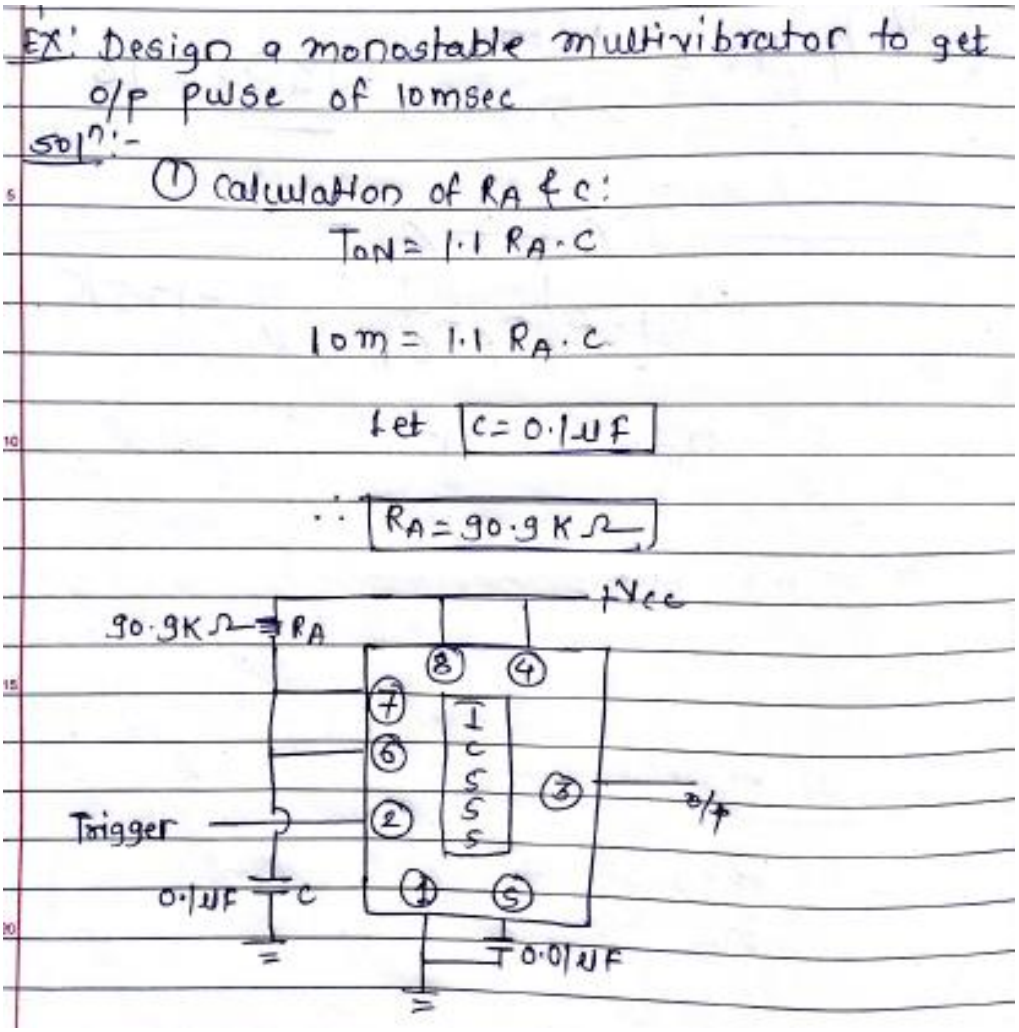
Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	A
Q2.	C
Q3.	A
Q4	A
Q5	B
Q6	B
Q7	C
Q8.	D
Q9.	D
Q10.	C
Q11.	A
Q12.	B
Q13.	C
Q14.	B
Q15.	A
Q16.	D
Q17.	C
Q18.	B
Q19.	C
Q20.	B

Important steps and final answer for the questions involving numerical example

Q2(A)(iii):



Q2(B)(i):

Ex:- Design a 1st order low pass filter at cut-off freq^n 1KHz with a passband gain of 2

Sol^n:- Given specifications:-

$f_H = 1KHz$ & $A_F = 2$

(1) Selection of capacitor C :-

Let $\boxed{C = 0.01\mu F}$

(2) Calculation of R :-

$$R = \frac{1}{2\pi f_H \cdot C} = \frac{1}{2\pi (1K)(0.01\mu)}$$

$$\boxed{R = 15.91K\Omega}$$

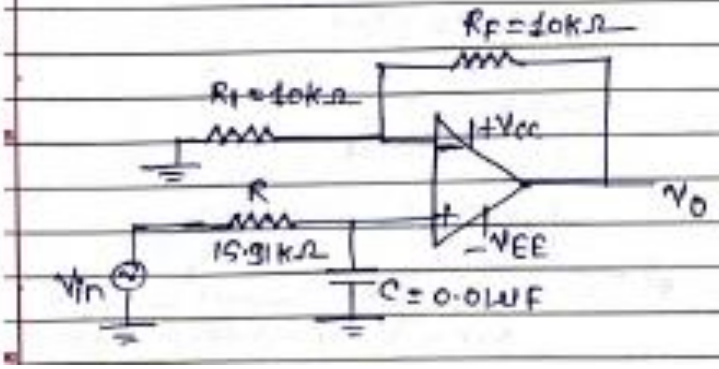
(3) Calculation of R_1 & R_2 :-

$$A_F = 1 + \frac{R_F}{R_1} = 2 \quad \text{(Given)}$$

$$\therefore 1 + \frac{R_F}{R_1} = 2$$

$$\therefore \frac{R_F}{R_1} = 1 \Rightarrow R_1 = R_F$$

Let, $\boxed{R_1 = R_F = 10K\Omega}$



Q3(A)(iii):

Ex: Design current source of 0.5A using IC7805

Design steps:-

① **Calculation of R -**

$$R = V_R / I_L$$

for IC7805, $V_R = 5V$

$$\therefore R = \frac{5}{I_L} = \frac{5}{0.5} = 10\,\Omega$$

$$\therefore \boxed{R = 10\,\Omega}$$

② **Calculation of o/p voltage (V_{out}):-**

$$V_{out} = V_R + I_L \cdot R_L$$

$$\therefore V_{out} = 5 + (0.5) R_L$$

Let $R_L = 10\,\Omega$

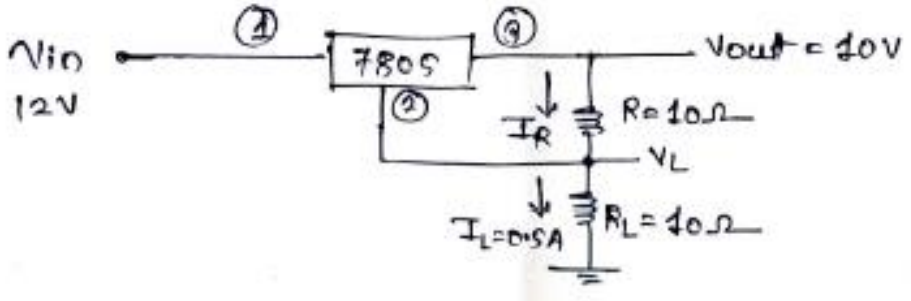
$$\therefore V_{out} = 5 + 0.5 \times 10 = 10V$$

③ **Calculation of $V_{in(min)}$ -**

$$V_{in} = V_{out} + V_{drop\_out}$$

$$= 10 + 2$$

$$\boxed{V_{in} = 12V} \longrightarrow \text{This is } V_{in(min)}$$



Q3(B)(ii):

Ex: Design an astable multivibrator to get o/p rectangular wave with 60% duty cycle at 2KHz freq^{n}.

Soln.

① Calculation of T_{ON} & T_{OFF} -

$f = \frac{1}{T} \Rightarrow T = \frac{1}{f} = \frac{1}{2KHz} = 500\mu s$

D = Duty cycle = $\frac{T_{ON}}{T} \Rightarrow T_{ON} = \frac{60}{100} \times 500\mu = 300\mu s$

$\therefore$ $T_{ON} = 300\mu s$

$\therefore$ $T_{OFF} = 200\mu s$

② Calculation of R_B & C :

$T_{OFF} = 0.69\, R_B \cdot C$

Let $C = 0.01\mu F$

$\therefore 200\mu = 0.69\,(R_B)(0.01\mu)$

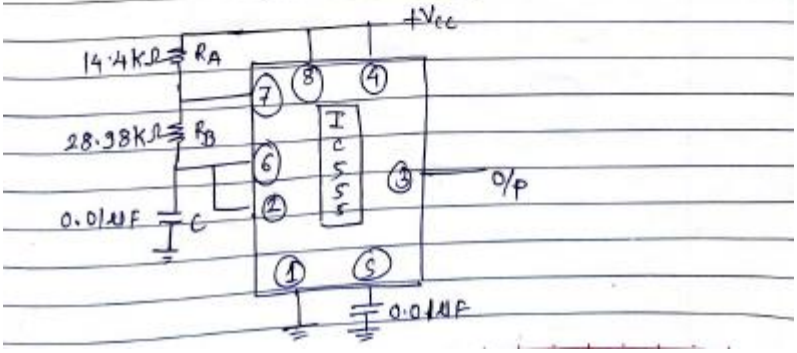
$\therefore$ $R_B = 28.985K\Omega$

③ Calculation of R_A :-

$T_{ON} = 0.69\,(R_A + R_B) \cdot C$

$\therefore 300\mu = 0.69\,(R_A + 28.985K) \cdot (0.01\mu)$

$\therefore$ $R_A = 14.4K\Omega$



University of Mumbai
Examination 2020 under Cluster 06
(Lead College: Vidyavardhini's College of Engg Tech)

Examination Commencing from 07th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev2012

Examination: TE Semester V

Course Code: **EXC 503** and Course Name: **Electromagnetic Engineering**

Time: 2 hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	According to Faraday's law, EMF stands for
Option A:	Electromagnetic field
Option B:	Electromagnetic force
Option C:	Electromagnetic friction
Option D:	Electromotive force
2.	In free space, the Poisson equation becomes
Option A:	Maxwell equation
Option B:	Ampere equation
Option C:	Laplace equation
Option D:	Steady state equation
3.	The point form of Ampere law is given by
Option A:	Curl(B) = I
Option B:	Curl(D) = J
Option C:	Curl(V) = I
Option D:	Curl(H) = J
4.	Which of the following relation will hold good?
Option A:	$D = \mu H$
Option B:	$B = \varepsilon E$
Option C:	$E = \varepsilon D$
Option D:	$B = \mu H$
5.	Which component of the electric field intensity is always continuous at the boundary?

Option A:	Tangential
Option B:	Normal
Option C:	Horizontal
Option D:	Vertical
6.	For a conservative field which of the following equations holds good?
Option A:	$\int E.dl = 0$
Option B:	$\int H.dl = 0$
Option C:	$\int B.dl = 0$
Option D:	$\int D.dl = 0$
7.	Find the force experienced by an electromagnetic wave in a conductor?
Option A:	Electrostatic force
Option B:	Magneto static force
Option C:	Electro motive force
Option D:	Lorentz force
8.	The divergence theorem converts
Option A:	Line to surface integral
Option B:	Surface to volume integral
Option C:	Volume to line integral
Option D:	Surface to line integral
9.	Equipotential surface is a
Option A:	Real surface
Option B:	Complex surface
Option C:	Imaginary surface
Option D:	Not existing surface
10.	A boundary of separation between two magnetic materials is identified by which factor?
Option A:	Change in the permeability
Option B:	Change in permittivity
Option C:	Change in magnetization
Option D:	Conduction

11.	The phase shift in the electric and magnetic fields in an EM wave is given by which parameter?
Option A:	phase constant
Option B:	attenuation constant
Option C:	propagation constant
Option D:	intrinsic impedance
12.	The Snell's law can be derived from which type of incidence?
Option A:	Incidence angle
Option B:	Reflected angle
Option C:	Refracted angle
Option D:	Oblique incidence
13.	The maximum power transceived by the antenna is in the region of
Option A:	Aperture
Option B:	Effective aperture
Option C:	Maxima lobe
Option D:	Minima lobe
14.	The Poynting vector is the power component that is calculated by the
Option A:	Product of E and H
Option B:	Ratio of E and H
Option C:	Dot product of E and H
Option D:	Cross product of E and H
15.	Skin depth phenomenon is found in which materials?
Option A:	Insulators
Option B:	Dielectrics
Option C:	Conductors
Option D:	Semiconductors
16.	The loss tangent is also referred to as
Option A:	Attenuation
Option B:	Propagation

Option C:	Dissipation factor
Option D:	Polarization
17.	When the Ex and Ey components of a wave are not same, the polarisation will be
Option A:	Linear
Option B:	Elliptical
Option C:	Circular
Option D:	Parallel
18.	When the polarisation of the receiving antenna is unknown, to ensure that it receives atleast half the power, the transmitted wave should be
Option A:	Linearly polarised
Option B:	Elliptically polarised
Option C:	Circularly polarised
Option D:	Normally polarised
19.	Which property of an electromagnetic wave, depends on the medium in which it is travelling?
Option A:	Velocity
Option B:	Frequency
Option C:	Time period
Option D:	Wave length
20.	The tropospheric scattering occurs at _____
Option A:	Beyond the LOS
Option B:	In ground wave propagation
Option C:	In sky wave propagation
Option D:	Below the radio horizon

Q2 **(20 Marks)**	
A	**Solve any Two 5 marks each**
i.	Derive, briefly the expression for divergence from gauss law.
ii.	Derive Poisson's and Laplace's equations.
iii.	What are the applications of skin effect?
B	**Solve any One** **10 marks each**
i.	Derive electric boundary conditions for dielectric-dielectric materials
ii.	State and explain four Maxwell's equation in differential form and its interpretations

Q3 **(20 Marks)**	
A	**Solve any Two 5 marks each**
i.	Define radiation intensity, directive gain, directivity and power gain of an antenna?
ii.	What is Poynting Theorem?
iii.	Derive the expression for half –wave di-pole antenna.
B	**Solve any One** **10 marks each**
i.	Determine the potential at the free nodes in potential system using FDM (Iterative Method)
ii.	Derive the expression for reflection and transmission co-efficients in case of reflection of plane waves at normal incidence.

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Program: **Electronics Engineering**

Curriculum Scheme: Rev2012

Examination: TE Semester V

Course Code: **EXC 503** and Course Name: **Electromagnetic Engineering**

Time: 2 hour Max. Marks: 80

==========

Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	D
Q2.	C
Q3.	D
Q4	D
Q5	A
Q6	A
Q7	D
Q8.	B
Q9.	C
Q10.	A
Q11.	D
Q12.	D
Q13.	B
Q14.	D
Q15.	C
Q16.	C
Q17.	B
Q18.	C
Q19.	A
Q20.	A

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Examination 2020 under Cluster 06
(Lead College: Vidyavardhini's College of Engg Tech)
Examinations Commencing from 7th January 2021 to 20th January 2021
Program: **Electronics Engineering**
Curriculum Scheme: Rev 2012
Examination: TE Semester V
Course Code: EXC504 and Course Name: Signals and Systems
Time: 2-hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	x(t) = x(at) is operation on signal.
Option A:	Time shifting
Option B:	Time scaling
Option C:	Amplitude scaling
Option D:	Folding
2.	Two systems with impulse responses h1 (t) and h2 (t) are connected in cascade. Then the overall impulse response of the cascaded system is given by
Option A:	Product of h1(t) and h2(t)
Option B:	Sum of h1(t) and h2(t)
Option C:	Convolution of h1(t) and h2(t)
Option D:	Subtraction of h2(t) from h1(t)
3.	Which one of following statements is NOT TRUE for a continuous time causal and stable LTI system?
Option A:	All the poles of the system must lie on the left side of the jω axis.
Option B:	Zeros of the system can lie anywhere in the s-plane.
Option C:	All the poles must lie within $\|S\| = 1$.
Option D:	All the roots of the characteristic equation must be located on the left side of the jω axis.
4.	Which of the following signal is not periodic?
Option A:	$s(t)=\cos(2t)+\cos(3t)+\cos(5t)$
Option B:	$s(t)=\exp(j8\pi t)$
Option C:	$s(t)=\exp(-7t)\sin(10\pi t)$
Option D:	$s(t)=\cos(2t)\cos(4t)$
5.	If a signal f(t) has energy E, the energy of the signal f(2t) is equal to
Option A:	E
Option B:	E/2
Option C:	2E
Option D:	4E
6.	For a periodic signal

	$v(t)$ = 30sin(100t) +10cos(300t) +6sin(500t+π/4), the fundamental frequency in rad/s is
Option A:	100
Option B:	300
Option C:	500
Option D:	1500
7.	The trigonometric Fourier series of an even function of time does not have
Option A:	The dc term
Option B:	Cosine terms
Option C:	Sine terms
Option D:	Odd harmonic terms
8.	The value of autocorrelation for periodic signals at the origin is equal to the
Option A:	Energy
Option B:	Power
Option C:	Area
Option D:	Duration
9.	A time invariant system is a system whose output
Option A:	increases with a delay in input
Option B:	decreases with a delay in input
Option C:	remains same with a delay in input
Option D:	vanishes with a delay in input
10.	Zero-input response is also known as _____
Option A:	Zero-state response
Option B:	Natural response
Option C:	State-input response
Option D:	Forced response
11.	Convolution of x[n] = {2, -1, 3} and h[n] = {1, 2, 2, 3}
Option A:	{2, 3, 5, 10, 3, 9}
Option B:	{3, 5, 10, 3, 9, 2}
Option C:	{5, 10, 3, 9, 2, 3}
Option D:	{10, 3, 9, 2, 3, 5}
12.	The Fourier transform of a function x(t) is X(f). The Fourier transform of $dx(t)/dt$ will be
Option A:	$dX(f)/dt$
Option B:	$j2\pi f\ X(f)$
Option C:	$jf\ X(f)$
Option D:	$X(f)/jf$
13.	For an energy signal --------
Option A:	E=0
Option B:	P= ∞
Option C:	E= ∞

Option D:	P=0
14.	If x (t) = x (-t) then the signal is said to be --------
Option A:	Even signal
Option B:	Odd signal
Option C:	Periodic signal
Option D:	Non periodic signal
15.	Which is not an example of memory system?
Option A:	Capacitive circuit
Option B:	Inductive circuit
Option C:	Resistive circuit
Option D:	Parallel RC circuit
16.	Find the Laplace transform of δ (t).
Option A:	1
Option B:	0
Option C:	∞
Option D:	2
17.	Find the Laplace transform of the signal x(t) = tu(t)
Option A:	$\frac{1}{s^2}$
Option B:	1
Option C:	$\frac{1}{s}$
Option D:	$\frac{1}{s^3}$
18.	The Z – transform of a system is, H(z) = $\frac{z}{(z-0.2)}$ If the ROC is $\|z\| < 0.2$, then the impulse response of the system is
Option A:	$(0.2)^n u[n]$
Option B:	$(0.2)^2 u[-n-1]$
Option C:	$-(0.2)^2 u[n]$
Option D:	$-(0.2)^n u[-n-1]$
19.	DTFT of x[n] = (δ[n+1] + δ[n-1]) is
Option A:	2cosω
Option B:	-2cosω
Option C:	cosω
Option D:	-cosω
20.	The ROC of a system is the
Option A:	range of z for which the z transform converges
Option B:	range of frequency for which the z transform exists
Option C:	range of frequency for which the signal gets transmitted
Option D:	range in which the signal is free of noise

Q2	**Solve any Two Questions out of Three 10 marks each**
A	Consider the continuous time signal $x(t) = 10cos(100\pi t)$. Find 1) Minimum sampling rate. 2) If the sampling frequency f_s =200 Hz, find the discrete time signal. 3) If the sampling frequency f_s =75 Hz, find the discrete time signal. 4) Comment on result obtained in (2) and (3) with justification.
B	Determine whether the following systems are linear/nonlinear, time variant /invariant and causal/ non causal. *i)* $y(t) = 3x(t^2)$ ii) $y(n) = nx^2(n)$
C	State and prove the Initial and Final value theorem of Laplace Transform.
Q3	**Solve any Two Questions out of Three 10 marks each**
A	Find the unique inverse transforms of the following, assuming each system is stable. i) $H_1(z) = \frac{z}{(z-0.4)(z+0.6)}$ ii) $H_2(z) = \frac{2.5z}{(z-0.5)(z+2)}$ iii) $H_3(z) = \frac{z}{(z-2)(z+3)}$
B	Find zero-state, zero-input and total response for the DT system represented by the difference equation $y[n] - 0.5y[n-1] = 2(0.25)^n u[n]$, with $y[-1] = -2$
C	Compute inverse Laplace transform of $X(s) = \frac{3s^2+19s+30}{(s+1)(s+2)^2}$ and also comment on the stability of the system.

University of Mumbai
Examination 2020 under Cluster 06
(Lead College: Vidyavardhini's College of Engg Tech)

Examination Commencing from 7th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2012

Examination: TE Semester V

Course Code: EXC504 and Course Name: Signal and Systems

Time: 2-hour Max. Marks: 80

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Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	B
Q2.	C
Q3.	C
Q4.	C
Q5.	B
Q6.	A
Q7.	C
Q8.	B
Q9.	C
Q10.	B
Q11.	A
Q12.	B
Q13.	D
Q14.	A
Q15.	C
Q16.	A
Q17.	A
Q18.	D
Q19.	A
Q20.	A

Q.2 A) :- Consider the continuous time signal $x(t) = 10cos100\pi t$. Find,

1) Minimum sampling rate.
2) If the sampling frequency f_s =200 Hz, find the discrete time signal.
3) If the sampling frequency f_s =75 Hz, find the discrete time signal.
4) Comment on result obtained in (2) and (3) with justification.

Ans.

Given, x (t) =10cos100πt

1) Therefore, the maximum frequency W = f = 100/2 = 50 Hz

The minimum sampling frequency, = f_s = 2w = 2*50 = 100Hz

The minimum sampling rate, =1/f_s = 1/100= 10 ms.

2) For f_s = 200Hz

Given x(t)=10cos100πt

The discrete time signal is obtained by replacing t with nTs

Therefore, x (n) = 10cos (nπ/2)

3) For f_s = 75Hz ;

x (n) = 10cos (100 π * n/75) = 10cos (4πn/3)

After simplifying we get,

x (n) = 10cos (2πn/3)

4) **Reconstructing the signals:- for reconstruction replace n by t* f_s**
For f_s = 200Hz

x (n) = 10cos (nπ/2)

Therefore, x (t) = 10cos (t*200*π/2) = **10cos100πt** ---------- original signal is obtained.

For f_s = 75Hz

x (n) = 10cos (2πn/3) = 10cos (2π*t*75/3) = **10cos50πt**

It indicates the aliasing error, because the sampling frequency (75 Hz) is less than the minimum required sampling frequency (100 Hz).

Q.2 B):- Determine whether the following systems are linear/nonlinear, time variant /invariant and causal/ non causal.

i) $y(t) = 3x(t^2)$ ii) $y(n) = nx^2(n)$

Ans:- Given,

i) $y(t) = 3x(t^2)$ **(Ans. Linear, Time variant and Non-causal)**

1) For linear / Non linear

Step I:-

Let $y_1(t) = 3x_1(t^2)$ and $y_2(t) = 3x_2(t^2)$

Therefore, $Y(t) = 3x_1(t^2) + 3x_2(t^2)$

Step II:-

Combine both the inputs , $X = x_1(t) + x_2(t)$

Therefore ,

$Y'(t) = 3[x_1(t^2) + x_2(t^2)] = 3x_1(t^2) + 3x_2(t^2)$

As , $Y(t) = Y'(t)$ This system is **Linear**

2) For Time Variant / Invariant

Given, $y(t) = 3x(t^2)$

Step I: Delay the input by t_0

$y(t, t_0) = 3x(t^2 - t_0)$

Step II: - Replace t by $(t - t_0)$ throughout the equation

$y(t - t_0) = 3x(t - t_0)^2$, As $y(t, t_0) \neq y(t - t_0)$ This system is **Time Variant**

3) For Causal / Non-causal system

Causal system: - If a system depends upon the present and past values of the given input and is independent of future values of input then the system is said to be causal system.

Non-causal system: - If a system depends upon the future values of the input at any instant of the time then the system is said to be non-causal system.

Given, $y(t) = 3x(t^2)$

For the given system, except t= 0 and t=1, output depends upon the future input .

Hence the given system is **non – causal system**

Similarly,

ii) $y(n) = nx^2(n)$

The given system is **Non-Linear, Time variant and Causal system**

Q3

A. i> $H_1(z) = \frac{z}{(z-0.4)(z+0.6)}$

$H_1(z) = \frac{z}{(z-0.4)} - \frac{z}{(z+0.6)}$

For stable system ROC must include unit circle

$H_1(z)$ is stable if its ROC is $|z| > 0.6$

Its inverse is causal, $h_1[n] = (0.4)^n u[n] - (-0.6)^n u[n]$

ii> $H_2(z) = \frac{2.5z}{(z-0.5)(z+2)}$

$H_2(z) = \frac{z}{(z-0.5)} - \frac{z}{(z+2)}$

$H_2(z)$ is stable if its ROC is $0.5 < |z| < 2$

Its inverse is two-sided, $h_2[n] = (0.5)^n u[n] + (-2)^n u[-n-1]$

iii> $H_3(z) = \frac{z}{(z-2)(z+3)}$

$H_3(z) = \frac{z}{(z-2)} - \frac{z}{(z+3)}$

$H_3(z)$ is stable if its ROC is $|z| < 2$.

Its inverse is anti-causal,

$h_3[n] = -(2)^n u[-n-1] + (-3)^n u[-n-1]$.

Q.3

B. $y[n] - 0.5y[n-1] = 2(0.25)^n u[n]$, $y[-1] = -2$

$$\therefore Y(z) - 0.5\{z^{-1}Y(z) + y[-1]\} = \frac{2z}{z-0.25}$$

$$\therefore (1-0.5z^{-1})Y(z) = \frac{2z}{z-0.25} - 1$$

* Zero-state response :- zero initial conditions

$$(1-0.5z^{-1})Y_{zs}(z) = \frac{2z}{(z-0.25)}$$

$$\therefore Y_{zs}(z) = \frac{2z^2}{(z-0.25)(z-0.5)}$$

$$\therefore Y_{zs}(z) = \frac{-2z}{(z-0.25)} + \frac{4z}{(z-0.5)}$$

$$\therefore y_{zs}[n] = -2(0.25)^n u[n] + 4(0.25)^n u[n]$$

* Zero-input response :- zero input

$$Y_{zi}(z) - 0.5\{z^{-1}Y_{zi}(z) + y[-1]\} = 0$$

$$\therefore Y_{zi}(z) = \frac{-z}{(z-0.5)}$$

$$\therefore y_{zi}[n] = -\left(\frac{1}{2}\right)^n u[n]$$

* Total response :-

$$y[n] = y_{zs}[n] + y_{zi}[n]$$

$$\therefore y[n] = -2(0.25)^n u[n] + 3(0.5)^n u[n]$$

Q.3

C. $$X(s) = \frac{3s^2+19s+30}{(s+1)(s+2)^2}$$

$$X(s) = \frac{K_1}{(s+1)} + \frac{A_0}{(s+2)^2} + \frac{A_1}{(s+2)}$$

$$K_1 = \left.\frac{3s^2+19s+30}{(s+2)^2}\right|_{s=-1} = 14$$

$$A_0 = \left.\frac{3s^2+19s+30}{(s+1)}\right|_{s=-2} = -4$$

$$A_1 = \frac{d}{ds}\left[\frac{3s^2+19s+30}{(s+1)}\right]\Bigg|_{s=-2} = -11$$

$$\therefore x(t) = (14e^{-t} - 4te^{-2t} - 11e^{-2t})u(t)$$

The system is stable.

University of Mumbai

Examination 2020 under Cluster 06

(Lead College: Vidyavardhini's College of Engg Tech)

Examination Commencing from 07th January 2021 to 20th January 2021

Program: **Electronics Engineering**

Curriculum Scheme: Rev 2012

Examination: TE Semester V

Course Code: EXC505 and Course Name: Digital Communication

Time: 2hour Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	The term ---------- is used to signify the functional relationship by which a real number is assigned to each possible outcome of an event.
Option A:	Probability density function
Option B:	Distribution function
Option C:	Stationary pdf
Option D:	Random variable
2.	A random variable is determined by a large number of independent events that tends to have a Gaussian probability distribution. This can be described using
Option A:	Central limit theorem
Option B:	Superposition
Option C:	Convolution
Option D:	Correlation
3.	Linear combination of two Gaussian random variables results to another random variable which is ------- in nature.
Option A:	Triangular
Option B:	Uniform
Option C:	Gaussian
Option D:	Rayleigh
4.	The following is not a unit of information
Option A:	Bit
Option B:	Nat
Option C:	Decit
Option D:	Hz
5.	The maximum entropy of a binary source occurs when
Option A:	P(0)=p(1)=0
Option B:	P(0)=p(1)=1
Option C:	P(0)=p(1)=0.5
Option D:	P(0)=p(1)=0.15
6.	Using the concept of information theory, it is possible to transmit error-free information at a rate of ---------- bits per second over a channel bandlimited to B Hz.

Option A:	B
Option B:	2B
Option C:	2B $\log_2(1+S/N)$
Option D:	B $\log_2(1+S/N)$
7.	A given discrete memoryless source will have maximum entropy provided the message generated are
Option A:	Statistically independent
Option B:	Statistically dependent
Option C:	Equiprobable
Option D:	Binary
8.	Huffman codes and Shannon Fano codes are
Option A:	Similar length code
Option B:	Equiprobable code
Option C:	Variable length code
Option D:	Equidistant code
9.	A channel has a bandwidth of 1MHz. The SNR for this channel is 63. The approximate bit rate is
Option A:	1 Mbps
Option B:	2 Mbps
Option C:	4 Mbps
Option D:	6 Mbps
10.	Which of the following is the technique for creating digital database of real signals?
Option A:	Pulse amplitude modulation
Option B:	Pulse code modulation
Option C:	Pulse position modulation
Option D:	Pulse width modulation
11.	The method using which the error propagation in duobinary signaling can be avoided is
Option A:	Filtering
Option B:	Convolution
Option C:	Postcoding
Option D:	precoding
12.	The phase angle difference between symbols of QPSK modulator is
Option A:	180 degrees
Option B:	90 degrees
Option C:	45 degrees
Option D:	22.5 degrees
13.	MSK stands for
Option A:	Maximum Shift Keying
Option B:	Many Shift Keying
Option C:	Minimum Shift Keying

Option D:	Mass Switch Key
14.	How many different symbols are possible at the output of 8 ary-PSK modulator?
Option A:	8
Option B:	16
Option C:	64
Option D:	256
15.	If minimum Hamming Distance in block code is 11, then it is capable to correct ___ number of errors.
Option A:	5
Option B:	10
Option C:	3
Option D:	1
16.	The non-zero output of the product $Y.H^T$ is called
Option A:	Entropy
Option B:	Information
Option C:	Syndrome
Option D:	Rate
17.	How many bits are grouped to form a QPSK symbol?
Option A:	2 bits per symbol
Option B:	3 bits per symbol
Option C:	4 bits per symbol
Option D:	6 bits per symbol
18.	Convolution codes are graphically represented with
Option A:	Eye diagram
Option B:	Trellis diagram
Option C:	Encoder diagram
Option D:	Decoder diagram
19.	The frequency hopping system uses --------- modulation scheme.
Option A:	BASK
Option B:	BPSK
Option C:	MFSK
Option D:	MPSK
20.	Frequency hopping involves a periodic change of transmission ____
Option A:	Signal
Option B:	Frequency
Option C:	Phase
Option D:	Amplitude

Option 1

Q2. **(20 Marks)**	**Solve any Four out of Six; 5 marks each**

A	*State and explain central limit theorem*
B	*Differentiate between Source Coding and Channel Coding.*
C	*What is optimum receiver. Explain in detail.*
D	*Compare offset QPSK and non-offset QPSK.*
E	*Explain direct sequence spread spectrum system and define anti jamming characteristics of spread spectrum system.*
F	*What is Eye Pattern? Explain its significance.*

Option 2

Q3. **(20 Marks)**	**Solve any Two Questions out of Three 10 marks each**
A	*Five source messages are probable to appear as* m_1*=0.4,* m_2 *=*m_3*=*m_4*=*m_5*=0.15. Find coding efficiency for (a)Shannon-Fano coding, (b)Huffman coding.*
B	*Draw the signal constellation diagram for 16-ary-QASK (with d =2a) and for 16-PSK system. Determine Euclidian distance for both the systems and compare. Which system has better noise immunity?*
C	*What is ISI? How it is caused? Derive expression for ISI and explain method to overcome ISI.*

University of Mumbai
Examination 2020 under Cluster 06
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Program: **Electronics Engineering**

Curriculum Scheme: Rev 2012

Examination: TE Semester V

Course Code: EXC505 and Course Name: Digital Communication

Time: 2hour Max. Marks: 80

==========

Q1:

Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	D
Q2.	A
Q3.	C
Q4	D
Q5	C
Q6	D
Q7	C
Q8.	C
Q9.	D
Q10.	B
Q11.	D
Q12.	B
Q13.	C
Q14.	A
Q15.	A
Q16.	C
Q17.	A
Q18.	B
Q19.	C
Q20.	B

Important steps and final answer for the questions involving numerical example

Q3(A): Average information =Entropy =H=2.171bits/message.

FOR SHANNON-FANO CODE

Average codeword length = 2.3bits/message

Coding efficiency = 2.171/2.3 = 0.9439 = 94.39%.

FOR HUFFMAN CODE

Average codeword length = 2.2bits/message

Coding efficiency = 2.171/2.2 = 0.9868 = 98.68%.