Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2016
Third Semester

15EC205 – SIGNALS AND SYSTEMS

(For the candidates admitted during the academic year 2015 – 2016 onwards)

Note:

(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.

(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer ALL Questions

1. For a linear shift invariant system, when input is sin(t), output is cos(t). so what is the output of the system when the input is cos t.
   (A) sin t (B) 0
   (C) -sin t (D) Cos t

2. Which of these properties does the system satisfy $y(t) = x(t).x(t-1)e^{x(t)\left|(x(t)+1)\right.}$
   (A) Additivity (B) Homogeneity
   (C) Shift invariance (D) Time variant

3. Given $x(t) = \sin t$ and $h(t) = 2e^{-2(t-1)}u(t-1)$. Compute the bound of $y(t) = x(t) * h(t)$
   (A) 1 (B) 2
   (C) 0 (D) y(t) is not bounded

4. The series inter connection of two non-linear systems is
   (A) Linear (B) Nonlinear
   (C) Time variant (D) Time invariant

5. The equation of average power of a periodic signal x(t) is given as,
   (A) $\sum_{k=0}^{\infty} |c_k|^2$ (B) $\sum_{k=-\infty}^{\infty} |c_k|$
   (C) $\sum_{k=-\infty}^{0} |c_k|^2$ (D) $\sum_{k=-\infty}^{\infty} |c_k|^2$

6. What is the spectrum that is obtained when we plot $|c_k|$ as a function of frequency?
   (A) Magnitude voltage spectrum (B) Phase spectrum
   (C) Power spectrum (D) Time signal

7. Which of the following relation is correct between Fourier transform X(f) and Fourier series coefficient c_k?
   (A) $c_k = X(F_o/k)$ (B) $c_k = \frac{1}{T_p}(X(F_o/k))$
   (C) $c_k = \frac{1}{T_p}(X(kF_o))$ (D) $c_k = T_p(X(kF_o))$

8. What are the Fourier series coefficients for the signal $x(n) = \cos\frac{\pi n}{3}$

(A) $c_0 = c_2 = c_3 = c_4 = 0; c_1 = c_5 = \frac{1}{2}$

(B) $c_0 = c_2 = c_3 = c_4 = 0; c_{-1} = c_{-5} = \frac{1}{2}$

(C) $c_0 = c_1 = c_2 = c_3 = c_4 = c_5 = \frac{1}{2}$

(D) $c_0 = c_1 = c_2 = c_3 = c_4 = c_5 = 0$

9. A Laplace transform exists when

(A) The function is piece wise continuous and is of exponential order

(B) The function is piece wise discrete

(C) The function is of differential order

(D) The function is of exponential order

10. Where is the ROC defined or specified for the signals containing causal as well as anti-causal terms?

(A) Greater than the largest pole

(B) Less than the smallest pole

(C) Between two poles

(D) Cannot be defined

11. According to the time shifting property of Laplace transform, shifting the signal in time domain corresponds to the

(A) Multiplication by e^{-st_0} in the time domain

(B) Multiplication by e^{-st_0} in the frequency domain

(C) Multiplication by e^{st_0} in the time domain

(D) Multiplication by e^{st_0} in the frequency domain

12. When is the continuous time system said to be causal as well as stable in accordance to pole/zero of ROC specified by system transfer function?

(A) Only if all the poles of system transfer function lie in left half of s-plane

(B) Right half of s-plane

(C) Inside the unit circle

(D) Outside the unit circle

13. Resolve the sequence $x(n) = \{2, \underset{\uparrow}{4}, 0, 3\}$ in to a sum of weighted impulse sequences

(A) $2\delta(n) + 4\,\delta(n-1) + 3\delta(n-3)$

(B) $2\delta(n+1) + 4\delta(n) + 3\delta(n-2)$

(C) $2\delta(n) + 4\delta(n-1) + 3\delta(n-2)$

(D) $2\delta(0-1) + 4\delta(n)$

14. What is the order of convolution

Step1 –folding

Step2 –multiplication with X(k)

Step3 – shifting

Step4 –summation

(A) 1-2-3-4

(B) 1-2-4-3

(C) 2-1-3-4

(D) 1-3-2-4

15. Determine the output y(n) of a LTI system with impulse response $h(n) = a^n u(n);\ |a| < 1$ with x(n) = u(n)

(A) $\left(1 - a^{(n+1)}\right) / (1 - a)$

(B) $\left(1 - a^{(n-1)}\right) / (1 - a)$

(C) $\left(1 + a^{(n+1)}\right) / (1 + a)$

(D) $\left(1 + a^{(n-1)}\right) / (1 + a)$

16. $x(n) * \delta(n-n_0) =$

(A) $x(n+n_0)$ (B) $x(n-n_0)$

(C) $x(-n-n_0)$ (D) $x(-n+n_0)$

17. Computational complexity in structure realization refers to the number of

(A) Additions (B) Arithmetic operations

(C) Multiplications (D) Divisions

18. What is the z transform of the signal $x(n) = (0.5)^n u(n)$?

(A) $\frac{1}{1-0.5z^{-1}}; ROC|z| > 0.5$ (B) $\frac{1}{1-0.5z^{-1}}; ROC|z| < 0.5$

(C) $\frac{1}{1+0.5z^{-1}}; ROC|z| > 0.5$ (D) $1/1+0.5z^{-1}; ROC|z| < 0.5$

19. What is the ROC of z transform of finite duration anti-causal sequence?

(A) z = 0 (B) z = ∞

(C) Entire z plane; except at z = 0 (D) Entire z plane; except at z = ∞

20. Circular convolution of two sequence $x_1(n) = \{\underset{\uparrow}{2},1,2,1\}$; $x_2(n) = \{\underset{\uparrow}{1},2,3,4\}$

(A) $\{\underset{\uparrow}{14},15,16,17\}$ (B) $\{\underset{\uparrow}{14},16,14,16\}$

(C) $\{\underset{\uparrow}{14},16,14,16\}$ (D) $\{\underset{\uparrow}{12},14,13,12\}$

PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

21. Write the equation and draw the signal for a exponentially rising and decaying sinusoidal signal.

22. Define linearity and non-linearity for a system and test the following system for linearity $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + 3y(t) = x(t)$.

23. Prove that the response y(t) of LTI continuous time system for an arbitrary input x(t) is given by convolution of input x(t) with impulse response h(t) of the system.

24.i. With neat sketches explain about Gibb's ocillations and Gibb's phenomenon.

ii. State the Dirichlet's condition.

25. Find the Laplace transform for $x(t) = e^{-4|t|}$; for all t and draw its ROC.

26. Determine the inverse z transform of $X(z) = \frac{1}{1-0.8z^{-1}+0.12z^{-2}}$ if the ROC is $|Z| > 0.6$.

27. What do you mean by canonic structure? Draw the canonic structure for $y(n)=\frac{-3}{8}y(n-1)+\frac{3}{32}y(n-2)+\frac{1}{64}y(n-3)+x(n)+3x(n-1)+2x(n-2)$.

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

28. a.i. Decompose the signal $x(t)=\cos t+\sin t+\cos t\sin t$ in to odd and even components.

ii. Check whether the signal is energy (or) power signal, $x(t)=e^{j\left(2t+\frac{\pi}{4}\right)}$.

iii. Find the fundamental time period if the given signal is periodic $x(n)=\cos\left(\frac{n\pi}{2}\right)-\sin\left(\frac{\pi n}{8}\right)+3\cos\left(\frac{n\pi}{4}+\frac{\pi}{3}\right)$.

(OR)

b. Explain in detail about systems and classification of systems with an example for each.

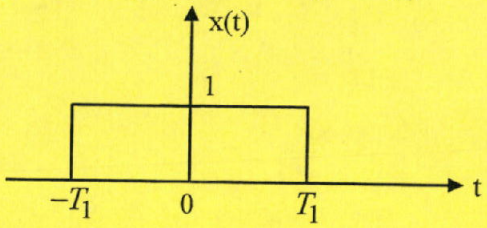
29. a.i. Find the Fourier series representation of $x(t)=2\sin(2\pi t-3)$. (4 Marks)

ii. State and prove the Parseval's relation for power signals in the case of Fourier series. (6 Marks)

iii. State and prove the time shifting property of Fourier transform. (2 Marks)

(OR)

b.i. Find the Fourier transform of a rectangular pulse signal x(t).



ii. Obtain the output response of a system, given the impulse response $h(t)=e^{-at}u(t)$.

30. a. Using Laplace transform determine the complete response of the system described by the equation $\frac{d^2y}{dt^2}+5\frac{dy(t)}{dt}+4y(t)=\frac{dx(t)}{dt};y(0)=0;\left.\frac{dy(t)}{dt}\right|_{t=0}=1$; for the input $x(t)=e^{-2t}u(t)$.

(OR)

b. Find the convolution of $x(t)=e^{-2t}.u(t)$ and h(t) = u(t+2) by using graphical method.

31. a. Determine the response of first order discrete time system governed by the difference equation, $y(n)=-0.5y(n-1)+x(n)$ when the input is unit step and with initial condition y (–1) = 0. Find the homogenous solution, particular solution and total response.

(OR)

b. State and derive the following properties discrete Fourier transform
   (i) Circular convolution
   (ii) Parseval's relation

32. a.i. Find $x(n)$ using partial fraction expansion method $X(z) = \dfrac{z-4}{(z-1)(z-2)^2}$. (8 Marks)

ii. Draw the mapping of s-plane to z plane. (4 Marks)

(OR)

b. Obtain the direct from-I, direct form-II, cascade and parallel form of the equation, $y(n) = +\frac{1}{2}y(n-1) - \frac{1}{3}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$.

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