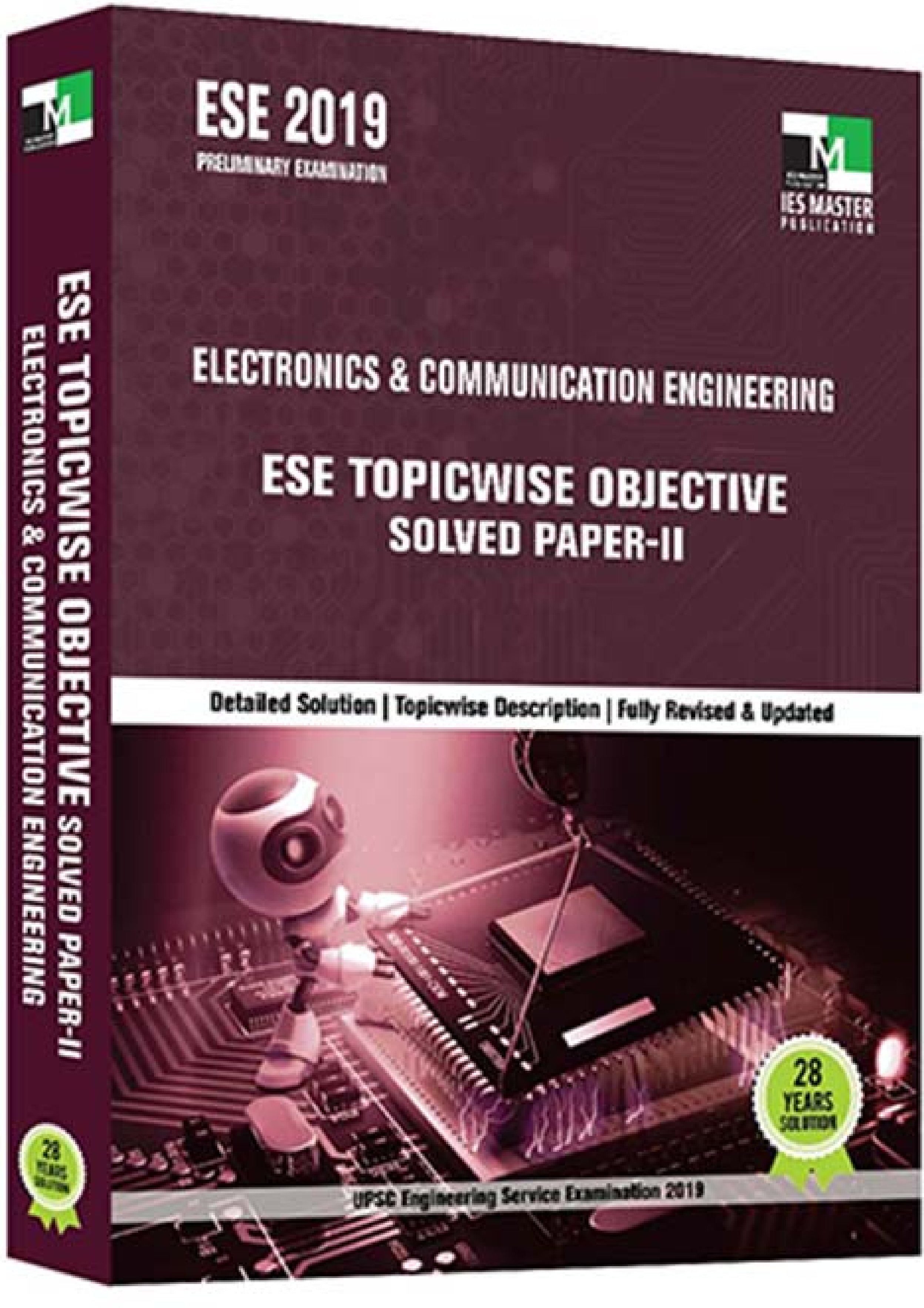

ESE 2019
PRELIMINARY EXAMINATION
IES MASTER
PUBLICATION
ELECTRONICS & COMMUNICATION ENGINEERING
ESE TOPICWISE OBJECTIVE
SOLVED PAPER-II
Detailed Solution | Topicwise Description | Fully Revised & Updated
28
YEARS
SOLUTION
UPSC Engineering Service Examination 2019
ESE TOPICWISE OBJECTIVE SOLVED PAPER-II
ELECTRONICS & COMMUNICATION ENGINEERING

ELECTRONICS AND COMMUNICATION ENGINEERING

ESE TOPICWISE OBJECTIVE SOLVED PAPER-II

From (1991 – 2018)

IES MASTER PUBLICATION

Office : F-126, (Lower Basement), Katwaria Sarai, New Delhi-110016 • **Phone :** 011-26522064
Mobile : 8130909220, 9711853908 • **E-mail:** info@iesmasterpublications.com, info@iesmaster.org
Web : iesmasterpublications.com, iesmaster.org

IES MASTER PUBLICATION

F-126, (Lower Basement), Katwaria Sarai, New Delhi-110016

Phone : 011-26522064, **Mobile :** 8130909220, 9711853908

E-mail : info@iesmasterpublications.com, info@iesmaster.org

Web : iesmasterpublications.com, iesmaster.org

First Edition : 2017

Second Edition : 2018

Typeset at : IES Master Publication, New Delhi-110016

PREFACE

It is an immense pleasure to present topic wise previous years solved paper of Engineering Services Exam. This booklet has come out after long observation and detailed interaction with the students preparing for Engineering Services Exam and includes detailed explanation to all questions. The approach has been to provide explanation in such a way that just by going through the solutions, students will be able to understand the basic concepts and will apply these concepts in solving other questions that might be asked in future exams.

Engineering Services Exam is a gateway to a immensly satisfying and high exposure job in engineering sector. The exposure to challenges and opportunities of leading the diverse field of engineering has been the main reason for students opting for this service as compared to others. To facilitate selection into these services, availability of arithmetic solution to previous year paper is the need of the day. Towards this end this book becomes indispensable.

Mr. Kanchan Kumar Thakur
Director–IES Master


IES MASTER
IES MASTER
Institute for Engineers (IES/GATE/PSUs)
Start Date
28th May
&
14th June
Genius Batch
for
ESE GATE PSUs
Get the rub-off with the best engineering minds
Uniform and collective progress
Regular practice tests
Focus on concepts and problem solving
Classes by highly experienced faculty
A Classroom Program for SMART LEARNERS
Call 80 1000 9955, 011 4101 3406
Register Now

Note: Direction of all **Assertion Reasoning (A–R)** type of questions covered in this booklet is as follows:

DIRECTIONS:

The following four items consist of two statements, one labelled as **'Assertion A'** and the other labelled as **'Reason R'.** You are to examine these two statements carefully and select the answer to these two statements carefully and select the answer to these items using the codes given below:

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true.

Note: Direction of all **Statement-I** and **Statement-II** type of questions covered in this booklet is as follows:

DIRECTION:

Following items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the code given below:

(a) Both Statement : (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I).

(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I).

(c) Statement (I) is true but Statement (II) is false

(d) Statement (I) is false but Statement (II) is true.

CONTENTS

Unit 1 Control System

SYLLABUS

Signal flow graphs, Routh-Hurwiz criteria, root loci, Nyquist/Bode plots Feedback systems-open & close loop types, stability analysis, steady state, transient and frequency response analysis; Design of control systems, Compensators, elements of lead/lag compensation, PID and industrial controllers.

■ Contents

CHAPTER 1

Basics of Control System, Block Diagram and Signal Flow Graph

IES – 2018

1. Consider the following statements for signal flow graph:

1. It represents linear as well as non linear systems.
2. It is not unique for a given system.

Which of the above statements is/are correct?

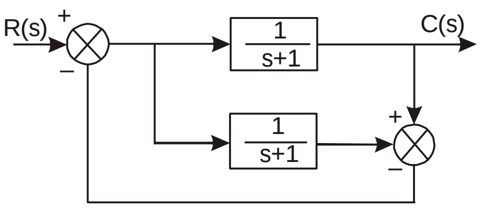
(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

2. The closed-loop transfer function C(s)/R(s) of the system represented by the block diagram in the figure is



(a) $\frac{1}{(s+1)^2}$ (b) $\frac{1}{(s+1)}$

(c) s+1 (d) 1

IES – 2015

3. The Laplace transform of $e^{-2t} \sin 2\omega t$ is

(a) $\frac{2s}{(s+2)^2+2\omega^2}$ (b) $\frac{2\omega}{(s-2)^2+4\omega^2}$

(c) $\frac{2\omega}{(s+2)^2+4\omega^2}$ (d) $\frac{2s}{(s-2)^2+2\omega^2}$

IES – 2013

4. The open-loop transfer function of a unity feedback control system is

$$G(s) = \frac{1}{(s+2)^2}$$

The closed loop transfer function poles are located at:

(a) –2, –2 (b) –2, –1

(c) –2, +2 (d) $-2 \pm j1$

5. In control systems, excessive bandwidth is NOT employed because:

(a) noise is proportional to bandwidth

(b) it leads to low relative stability

(c) it leads to slower response

(d) noise is proportional to the square of the bandwidth

IES – 2012

6. A system is described by the transfer function $G(s) = \frac{2s+5}{(s+5)(s+4)}$. The dc gain of the

system is

(a) 0.25 (b) 0.5

(c) 1 (d) ∞

7. The sensitivity S_K^T of transfer function $T = \frac{(1+2K)}{(3+4K)}$ with respect to the parameter K is given by

(a) $\frac{K}{3+K^2}$

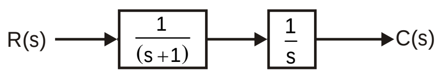
(b) $\frac{3K}{2+4K+K^2}$

(c) $\frac{2K}{3+10K+8K^2}$

(d) $\frac{4K}{2+5K+7K^2}$

IES – 2011

8. What is the unit impulse response of the system shown in figure for $t \geq 0$?



(a) $1+e^{-t}$ (b) $1-e^{-t}$

(c) e^{-t} (d) $-e^{-t}$

9. Given the differential equation model of a physical system, determine the time constant of the system

$$40\frac{dx}{dt}+2x = f(t)$$

(a) 10 (b) 20

(c) 1/10 (d) 4

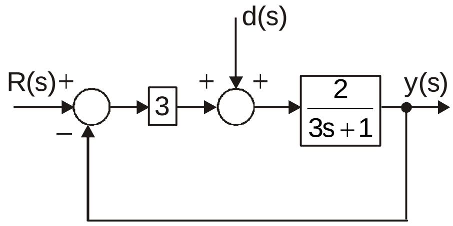
IES – 2010

10. A linear time-invariant system is initially at rest, when subjected to a unit-step input, gives a response $y(t) = te^{-t}, t > 0$. The transfer function of the system is:

(a) $\frac{1}{(s+1)^2}$ (b) $\frac{1}{s(s+1)^2}$

(c) $\frac{s}{(s+1)^2}$ (d) $\frac{1}{s+1}$

11.



The transfer function from d(s) to y(s) is:

(a) $\frac{2}{3s+7}$ (b) $\frac{2}{3s+1}$

(c) $\frac{6}{3s+7}$ (d) $\frac{2}{3s+6}$

IES – 2009

12. Consider the function F(s) = $\frac{\omega}{s^2+\omega^2}$ where F(s) is the Laplace transform of f(t). What is the steady state value of f(t)?

(a) Zero

(b) One

(c) Two

(d) A value between –1and +1

13. What is the characteristic of a good control system ?

(a) Sensitive to parameter variation

(b) Insensitive to input command

(c) Neither sensitive to parameter variation nor sensitive to input commands.

(d) Insensitive to parameter variation but sensitive to input commands.

14. A negative-feedback closed-loop system is supplied with an input of 5V. The system has a forward gain of 1 and a feedback gain of 1. What is the output voltage ?

(a) 1.0 V (b) 1.5 V

(c) 2.0 V (d) 2.5 V

15. In closed loop control system, what is the sensitivity of the gain of the overall system, M to the variation in G ?

(a) $\frac{1}{1+G(s)H(s)}$ (b) $\frac{1}{1+G(s)}$

(c) $\frac{G(s)}{1+G(s)H(s)}$ (d) $\frac{G(s)}{1+G(s)}$

ANSWER KEY

1. (c)	10. (c)	19. (d)	28. (b)	37. (b)	46. (b)
2. (b)	11. (a)	20. (c)	29. (c)	38. (a)	47. (a)
3. (c)	12. (d)	21. (b)	30. (a)	39. (d)	48. (a)
4. (d)	13. (d)	22. (c)	31. (a)	40. (d)	49. (a)
5. (a)	14. (d)	23. (b)	32. (b)	41. (d)	
6. (a)	15. (a)	24. (b)	33. (a)	42. (c)	
7. (c)	16. (c)	25. (d)	34. (a)	43. (d)	
8. (b)	17. (c)	26. (b)	35. (b)	44. (a)	
9. (b)	18. (a)	27. (b)	36. (c)	45. (b)	

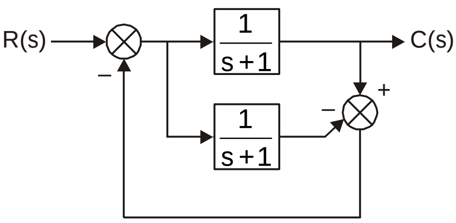
SOLUTION...

Sol–1: **(c)**

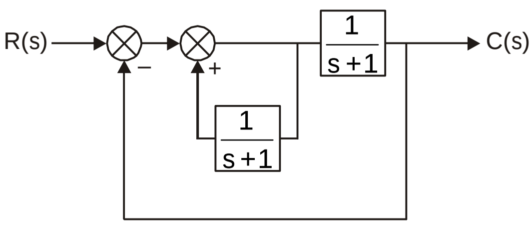
The signal flow graph approach is valid for linear as well as non-linear systems.

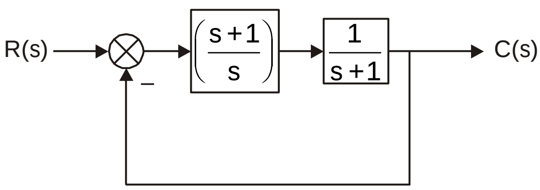
One system can have different signal flow graph according to the order in which the equations are used to define the variable written on the left hand side. So it is not unique for a given system.

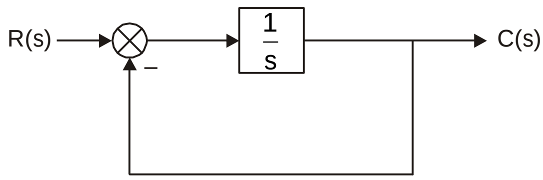
Sol–2: **(b)**



⇓







$$\frac{C(s)}{R(s)} = \frac{\frac{1}{s}}{1+\frac{1}{s}} = \left(\frac{1}{s+1}\right)$$

Sol–3. **(c)**

$$L\left[e^{-2t}\sin 2\omega t\right] = ?$$

$$L[\sin 2\omega t] = \frac{2\omega}{s^2+(2\omega)^2} = \frac{2\omega}{s^2+4\omega^2}$$

$$\therefore\ L\left[e^{-2t}\times\sin 2\omega t\right] = \frac{2\omega}{(s+2)^2+4\omega^2}$$

Sol–4. **(d)**

Closed loop poles are roots of characteristic equation $1 + G(s)H(s) = 0$

or, $1 + G(s) = 0$ {as $H(s) = 1$}

or, $1+\frac{1}{(s+2)^2} = 0$

or, $(s + 2)^2 + 1 = 0$

or, $s^2 + 4s + 5 = 0$

or, $$s = \frac{-4 \pm \sqrt{16 - 4 \times 1 \times 5}}{2}$$

$$= \frac{-4 \pm \sqrt{-4}}{2} = (-2 \pm j)$$

Sol–5. (a)

Noise is proportional to bandwidth as

$$P = K.T(B)$$

Where B = Bandwidth

It is clear that as Bandwidth increases, noise also increases.

Sol–6. (a)

$$G(s) = \frac{2s+5}{(s+5)(s+4)}$$

$$= \frac{5\left(1+\frac{2}{5}s\right)}{5 \times 4\left(1+\frac{s}{5}\right)\left(1+\frac{s}{4}\right)}$$

To find DC gain – first arrange system in time constant form and then put

s = 0 as for DC, f = 0 $\Rightarrow \omega = 0 \Rightarrow s = j\omega = 0$

$$|G(s)|_{s=0} = \frac{5(1+0)}{5 \times 4(1+0)(1+0)} = 0.25$$

Sol–7. (c)

$$s_K^T = \frac{\partial T/T}{\partial K/K} = \frac{K}{T}.\frac{\partial T}{\partial K}$$

$$= \frac{K(3+4K)}{1+2K} \times \frac{(0+2)(3+4K)-(1+2K)(0+4)}{(3+4K)^2}$$

$$= \frac{K(3+4K)}{(1+2K)} \times \frac{6+8K-4-8K}{(3+4K)^2}$$

$$= \frac{2K}{(1+2K)(3+4K))}$$

$$= \frac{2K}{8K^2+10K+3}$$

Sol–8. (b)

$$\text{Transfer Function} = \frac{1}{(s+1)} \times \frac{1}{s} = \frac{1}{s(s+1)}$$

$$\text{Impulse response} = L^{-1}\left\{\frac{1}{s(s+1)}\right\}$$

$$= L^{-1}\left\{\frac{1}{s} - \frac{1}{(s+1)}\right\}$$

$$= (1-e^{-t})u(t)$$

Sol–9. (b)

$$40.\frac{dx}{dt} + 2x = f(t)$$

Applying Laplace Transform on both sides

40sX(s) + 2 X(s) = F(s)

or, $$\frac{X(s)}{F(s)} = \frac{1}{40s+2} = \left(\frac{1}{40}\right)\frac{1}{s+\frac{1}{20}}$$

or, $$X(s) = \left(\frac{1}{40}\right)\frac{1}{s+\frac{1}{20}}$$

or, $x(t) = (1/40).e^{-(t/20)}$

Time constant = 20 sec.

Sol–10. (c)

$$y(t) = te^{-t}$$

Applying Laplace Transform

$$Y(s) = L\{y(t)\} = \frac{1}{(s+1)^2}$$

$$r(t) = u(t)$$

$$R(s) = L\{u(t)\} = 1/s$$

$$\text{Transfer Function} = \frac{Y(s)}{R(s)} = \frac{s}{(s+1)^2}.$$

Sol–11. (a)

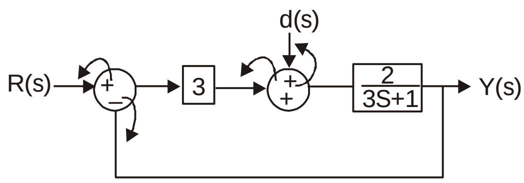
To calculate $\frac{y(s)}{d(s)}$

Step 1: Put other inputs and outputs which are irrelevant as zero.

Step 2. Take out all the polarities from the mixer.

Step 3. Draw the block diagram again and insert the polarities.

Step 4. Find the transfer function.



IES MASTER PUBLICATION

F-126 (Lower Basement), Katwaria Sarai, New Delhi-110016
Phone : 011 26522064, **Mobile :** 97 1185 3908
E-mail : info@iesmasterpublications.com, info@iesmaster.org
Web : iesmasterpublications.com

₹ 800.00

ISBN 978-93-86383-84-6