ESE 2019

PRELIMINARY EXAMINATION

IES MASTER PUBLICATION

ELECTRICAL ENGINEERING

ESE TOPICWISE OBJECTIVE

SOLVED PAPER-I

Detailed Solution | Topicwise Description | Fully Revised & Updated

UPSC Engineering Service Examination 2019

ELECTRICAL ENGINEERING

ESE TOPICWISE OBJECTIVE
SOLVED PAPER-I

From (1992 – 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

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

IES MASTER

Institute for Engineers (IES/GATE/PSUs)

ESE 2019 Prelims Offline Test Series

Starting from

24th Sept. 2018

General Studies & Engineering Aptitude

(Paper-I)

- 9 Subject-wise Tests
- 3 Full Length Tests

Engineering Discipline

(Paper-II)

- 10 Mixed Tests
- 4 Full Length Tests

Total 26 Tests

Call 97118 53908, 80100 09955

APPLY ONLINE

Unit 1

Circuit Theory

SYLLABUS

Circuits elements. Kirchoff's Laws. Mesh and nodal analysis. Network Theorems and applications. Natural response and forced response. Transient response and steady state response for arbitrary inputs. Properties of networks in terms of poles and zeros. Transfer function. Resonant circuits. Three-phase circuits. Two-port networks. Elements of two-element network synthesis.

Contents

CHAPTER 1

Network Elements

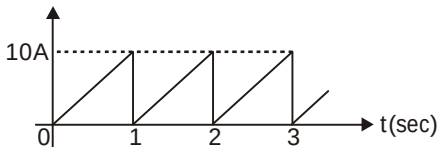
IES – 1992

1. The number of turns of a coil having a time constant T are doubled. Then the new time constant will be

(a) T (b) 2T

(c) 4T (d) T/2

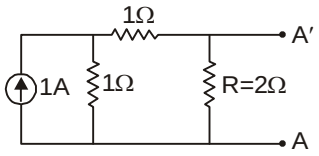
2. Current having wave form shown is flowing in a resistance of 10 ohms. The average power is



(a) $\frac{1000}{1}$W (b) $\frac{1000}{2}$W

(c) $\frac{1000}{3}$W (d) $\frac{1000}{4}$W

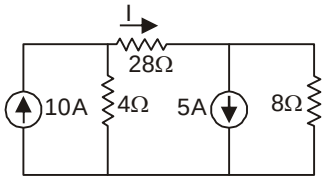
3. In the figure shown, if we connect a source of 2 V, with internal resistance of 1Ω at A'A, with positive terminal at A', then the current through R is



(a) 2 A (b) 1.66 A

(c) 1 A (d) 0.625 A

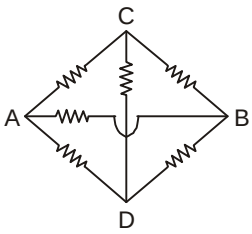
4. In the circuit shown the value of I is



(a) 1 A (b) 2 A

(c) 4 A (d) 8 A

5. When all the resistances in the circuit are of one ohm each, the equivalent resistance across the points A and B will be



(a) 1Ω (b) 0.5Ω

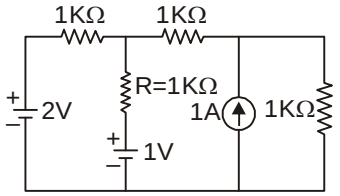
(c) 2Ω (d) 1.5Ω

6. A battery is connected to a resistance causing a current of 0.5 A in the circuit. The current drops to 0.4 A when additional resistance of 5Ω is connected in series. The current will drop to 0.2 A when the resistance is

(a) 10Ω (b) 15Ω

(c) 25Ω (d) 30Ω

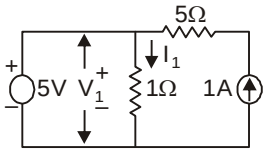
7. The current in resistor R shown in figure will be



(a) 0.2 A (b) 0.4 A

(c) 0.6 A (d) 0.8 A

8. The circuit shown is a linear time invariant one and the sources are ideal. Choose from the answers given below, the values of voltage across and current through 1Ω resistor.



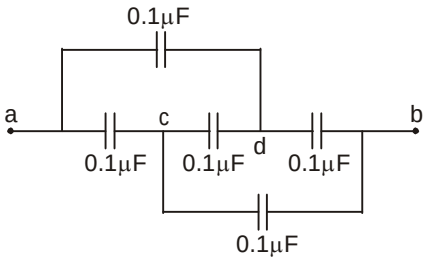
(a) 1V, 1A

(b) 1V, 6A

(c) 5V, 5A

(d) None of the above

9. The equivalent capacitance across ab will be :



(a) 0.2μF (b) 0.1μF

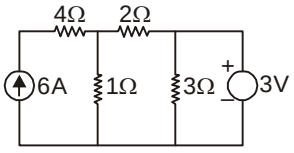
(c) 0.5μF (d) 0

IES – 1993

10. **Assertion (A) :** Kirchhoff's current law is valid for an ac circuit containing R, L and C.

Reason (R) : The sum of rms currents at any junction of the circuit is always zero.

11. In the circuit shown in the figure, the voltage across the 2 ohm resistor is



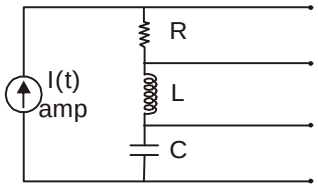
(a) 6 V (b) 4 V

(c) 2 V (d) zero

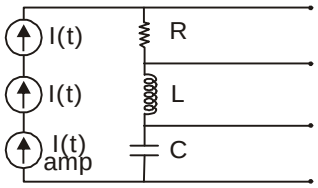
IES – 1994

12. Four networks are shown below in figures (1), (2), (3) and (4)

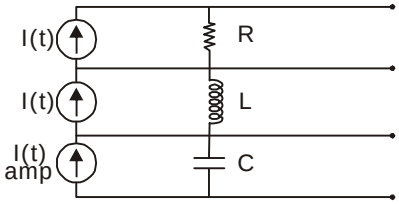
1.



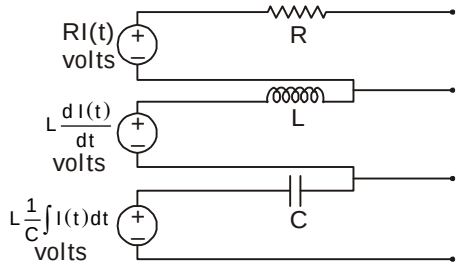
2.



3.



4.



Of these networks,

(a) all the four networks are equivalent

(b) no two networks are equivalent

(c) networks shown in figures (2), (3) and (4) are equivalent

(d) networks shown in figures (3) and (4) are equivalent

13. The number of 2μF , 400 V capacitors needed to obtain a capacitance value of 1.5μF rated for 1600 V is

(a) 12 (b) 8

(c) 6 (d) 4

ANSWER KEY

1.	(c)	30.	(c)	59.	(c)	88.	(b)
2.	(c)	31.	(c)	60.	(b)	89.	(d)
3.	(d)	32.	(c)	61.	(c)	90.	(c)
4.	(b)	33.	(a)	62.	(a)	91.	(c)
5.	(b)	34.	(a)	63.	(c)	92.	(a)
6.	(d)	35.	(b)	64.	(a)	93.	(b)
7.	(a)	36.	(b)	65.	(d)	94.	(c)
8.	(c)	37.	(b)	66.	(a)	95.	(c)
9.	(b)	38.	(b)	67.	(a)	96.	(b)
10.	(c)	39.	(d)	68.	(c)	97.	(a)
11.	(c)	40.	(b)	69.	(c)	98.	(d)
12.	(a)	41.	(c)	70.	(d)	99.	(a)
13.	(a)	42.	(c)	71.	(a)	100.	(c)
14.	(b)	43.	(b)	72.	(a)	101.	(a)
15.	(c)	44.	(b)	73.	(d)	102.	(d)
16.	(d)	45.	(b)	74.	(b)	103.	(b)
17.	(c)	46.	(a)	75.	(b)	104.	(b)
18.	(a)	47.	(c)	76.	(b)	105.	(b)
19.	(d)	48.	(a)	77.	(c)	106.	(c)
20.	(d)	49.	(d)	78.	(b)	107.	(b)
21.	(d)	50.	(b)	79.	(c)	108.	(d)
22.	(c)	51.	(a)	80.	(b)	109.	(a)
23.	(b)	52.	(a)	81.	(b)	110.	(a)
24.	(c)	53.	(b)	82.	(b)	111.	(a)
25.	(c)	54.	(a)	83.	(a)	112.	(b)
26.	(d)	55.	(none)	84.	(d)	113.	(c)
27.	(a)	56.	(c)	85.	(d)	114.	(a)
28.	(c)	57.	(b)	86.	(c)	115.	(c)
29.	(b)	58.	(a)	87.	(a)	116.	(none)

117.	**(d)**	**127.**	**(d)**	**137.**	**(b)**	**147.**	**(b)**
118.	**(b)**	**128.**	**(b)**	**138.**	**(b)**	**148.**	**(b)**
119.	**(a)**	**129.**	**(c)**	**139.**	**(b)**	**149.**	**(b)**
120.	**(d)**	**130.**	**(c)**	**140.**	**(b)**	**150.**	**(a)**
121.	**(c)**	**131.**	**(d)**	**141.**	**(c)**	**151.**	**(a)**
122.	**(a)**	**132.**	**(b)**	**142.**	**(b)**	**152.**	**(b)**
123.	**(none)**	**133.**	**(b)**	**143.**	**(a)**	**153.**	**(a)**
124.	**(b)**	**134.**	**(c)**	**144.**	**(d)**	**154.**	**(b)**
125.	**(d)**	**135.**	**(none)**	**145.**	**(c)**	**155.**	**(b)**
126.	**(b)**	**136.**	**(d)**	**146.**	**(d)**		

SOLUTION...

Sol–1: (c)

$$\text{Inductance (L)} = \mu_0\mu_r \frac{N^2A}{l}$$

$$\text{Resistance (R)} = \frac{\rho l}{A}$$

$$\therefore \text{ Time constant} = \frac{L}{R} = \frac{\mu_0\mu_r}{\rho}\frac{N^2A^2}{l^2}$$

or $T \propto N^2$

When no. of turns of a coil is doubled N' = 2N, new time constant is T'

$$\Rightarrow \frac{T'}{T} = \frac{N'^2}{N^2} = \frac{(2N)^2}{N^2} = 4$$

$$T' = 4T$$

Sol–2: (c)

Given: $R = 10\Omega$, $T = 1\text{sec}$

$i(t) = 10t; \quad 0 < t < 1$

$\because$ Power $[P(t)] = i^2(t)\,R$

$= (10t)^2 \times 10 = 1000\,t^2$

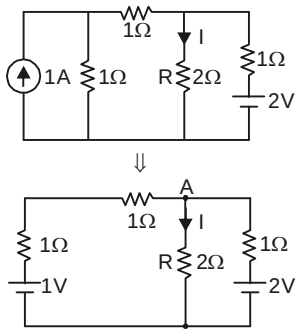
$\therefore$ Average power (P_{avg})

$$= \frac{1}{T}\int_0^T P(t)dt = \frac{1}{1}\int_0^1 1000t^2dt$$

$$= 1000\left[\frac{t^3}{3}\right]_0^1 = \frac{1000}{3}\text{W}$$

Sol–3: (d)

Connect source of 2V with internal resistance of 1Ω in the given figure. The figure is



KCL at node A,

$$\frac{V_A - 1}{2} + \frac{V_A - 2}{1} + \frac{V_A}{2} = 0$$

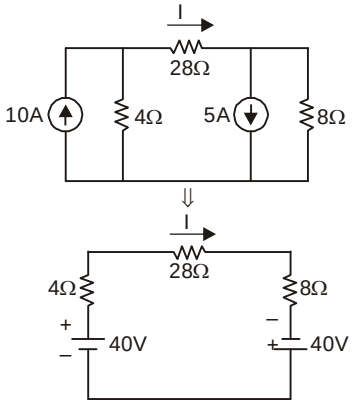
$$2V_A - 1 + 2V_A - 4 = 0$$

$$V_A = (5/4)V$$

$\therefore$ Current through R is,

$$I = \frac{V_A}{2} = \frac{5/4}{2} = 0.625\text{A}$$

Sol–4: (b)



In the circuit, applying KVL,

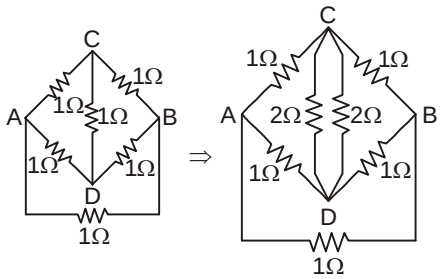
$-40 + 4I + 28I + 8I - 40 = 0$

$40\ I = 80$

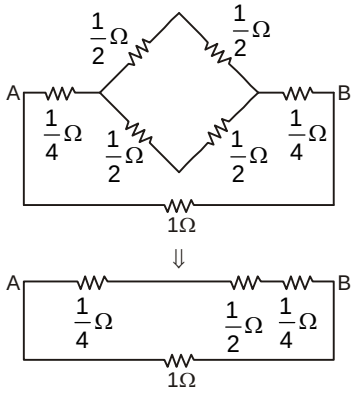
$I = \frac{80}{40} = 2A$

Sol–5: (b)

Given all the resistance of the circuit are 1Ω.

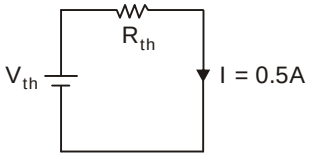


Using delta to star conversion.



$\therefore \quad R_{AB} = 1 \| 1 = 0.5\Omega$

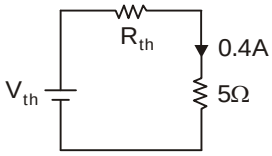
Sol–6: (d)



$I = \frac{V_{th}}{R_{th}} = 0.5$

$V_{th} = 0.5\ R_{th}$ ...(1)

When additional resistance of 5Ω is connected in series, current drops to 0.4A, then circuit is



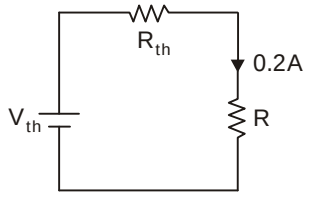
$\Rightarrow \quad 0.4 = \frac{V_{th}}{R_{th} + 5}$

$0.4\ R_{th} + 2 = V_{th} = 0.5\ R_{th}$

(from equation (1))

$R_{th} = 20\Omega$

When connected resistance R in series, current drops to 0.2A



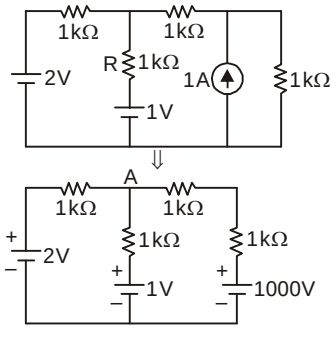
$\therefore \quad 0.2 = \frac{V_{th}}{R_{th} + R}$

$0.2\ R_{th} + 0.2R = V_{th} = 0.5\ R_{th}$

(from equation (1))

$R = \frac{3}{2}R_{th} = \frac{3}{2} \times 20 = 30\Omega$

Sol–7: (a)



Download
IES Master App
for FREE!

Pocket the Knowledge

As a maverick ESE/GATE platform, we embark upon being your learning partner, in your pursuit of excellence.

True to the likings of engineering students, here, information comes crisp, compact and exact, accompanied by myriad of illustrations that one's eyes can feast upon, and brain to exercise and hone its capabilities. We believe that illustrations speak louder than words; and figurines communicate faster than complex wordy pages.

As your eyeballs roll through the app, concepts on all topics – from Material Science to Currents, right from the ESE and GATE toppers - shall come alive before you.

In the swarm of devices based on touch-based, smart technology, IES Master App literally manifests its belief that a right 'touch' can change one's world.

Features

- ✓ Daily updates
- ✓ Timely notifications
- ✓ On the fly bookmark of important notes and questions
- ✓ Practice questions on all topics
- ✓ Study materials - in the form of notes, quizzes and videos

Also visit @
iesmaster.org | iesmasterpublications.com

Like us on facebook /iesmaster01 | Follow us on twitter /ies_master | Watch us on youtube /iesmaster01

Buy Online | amazon.com | Flipkart | snapdeal | https://iesmasterpublications.com

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

₹ 750.00

ISBN 978-93-86383-76-1