

# UGC-NET

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## Electronic Science

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# Preface

It is commonly said “Teaching is the profession which creates all other professions” and “Research is the new knowledge”; so aren’t these professions an instruments to serve the nation?

Of course yes, from Dr.S.Radhakrishnan to Dr. APJ Abdul Kalam, they will be remembered for their marvellous works, apart from technical jobs in engineering services or PSUs, this is equally a good choice to contribute in the saga of India’s development. UGC-NET provides opportunity for budding engineers to become future renowned scholars of this country and entire world.

This is one such exam which opens a direct gateway to lectureship in colleges, universities as an Assistant Professor and also to make remarkable progress in the field of research by awarding JRF.

Preparation of any exam is complete only when set of variety of questions is practised. To help all the students in their preparation MADE EASY team made efforts and came up with compilation of all previous years’ questions of UGC-NET exam with accurate and detailed solutions. This book is not only helpful for UGC-NET but also for GATE, ISRO, DRDO, HAL, BARC, CIL, BHEL, BEL, UPPCL, GAIL, DMRC and other competitive exams and other competitive exams for engineering graduates.

I would like to give credit to MADE EASY team for solving previous years’ questions with correctness and making it a medium to serve students. Providing good study material and quality guidance are two ways to help each and every student and this book fulfils my aim to contribute in success of every aspirant.



**B. Singh** (Ex. IES)

With Best Wishes

**B. Singh (Ex-IES)**

CMD, MADE EASY Group

# UGC-NET

## Previous Year Solved Papers

### Electronic Science

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1. In a JFET the change in drain current is due to the applied

- (a) Electric field between  $S$  and  $D$ .
- (b) Electric field between  $G$  and  $S$ .
- (c) Magnetic field between  $S$  and  $D$ .
- (d) Magnetic field between  $G$  and  $S$ .

2. The increase in temperature, the electrical conductivity would

- (a) increase in metals as well as increase in semiconductors
- (b) increase in metals but decrease in semiconductors
- (c) decrease in metals but increase in semiconductors
- (d) decrease in metals as well as in semiconductors

3. A network contains only independent current sources and resistors. If values of all resistors are doubled, then values of node voltages

- (a) will become half
- (b) will remain unchanged
- (c) will become double
- (d) cannot be determined unless circuit configuration and values of the resistors are known

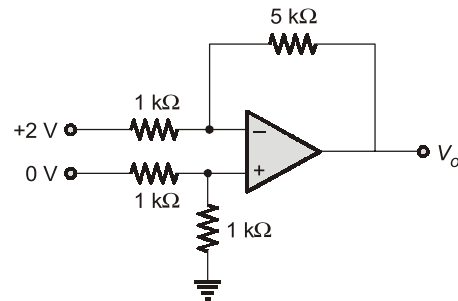
4. Thevenin's theorem replaces a complicated circuit facing a load by an

- (a) ideal voltage source and parallel resistor
- (b) ideal current source and parallel resistor
- (c) ideal current source and series resistor
- (d) ideal voltage source and series resistor

5. When Op-Amp is used as an integrator, the feedback element is

- (a) Resistor
- (b) Capacitor
- (c) Zener diode
- (d) Voltage divider

6. The output  $V_o$  of the ideal Op-Amp circuit shown in the figure is



- (a)  $-10\text{ V}$
- (b)  $-5\text{ V}$
- (c)  $5\text{ V}$
- (d)  $10\text{ V}$

7. How many Flip-Flops are required to build a binary counter circuit to count from 0 to 1023?

- (a) 1
- (b) 6
- (c) 10
- (d) 24

8. Among the following, the slowest ADC (Analog-to-digital converter) is

- (a) Parallel-comparator (i.e.) flash type
- (b) Successive approximation type
- (c) Integrating type
- (d) Counting type

9. In a microcomputer, WAIT states are used to

- (a) make the processor wait during a DMA operation
- (b) make the processor wait during a power interrupt processing
- (c) make the processor wait during a power shut down
- (d) interface slow peripherals to the processor

10. In a microprocessor, the register which holds the address of the next instruction to be fetched is

- (a) Accumulator
- (b) Program Counter
- (c) Stack Pointer
- (d) Instruction Register

11. Consider the following structure and declaration:

```
1. struct date {
2.   int day;
3.   int month;
4.   int year;
5. };
Struct data *pd ;
```

Which of the following is the correct method to refer to the year member?

- (a) (\*pd) · year      (b) (\*pd)\*year  
(c) (\*pd) → year      (d) pd → year

**12.** Which of the following is not a linear data structure?

- (a) Array      (b) Linked list  
(c) Stack      (d) Tree

**13.**  $\nabla^2 V = -\frac{\rho}{\epsilon}$  represents

- (a) Maxwell's      (b) equation  
(c) Laplace's equation      (d) Gauss's law

**14.** The energy per unit time, per unit area transported by the electromagnetic fields is expressed as

- (a)  $\vec{S} = \frac{1}{\mu_0} (\vec{E} \times \vec{B})$       (b)  $\vec{S} = (\vec{E} \times \vec{B})$   
(c)  $\vec{S} = \mu_0 (\vec{E} \times \vec{B})$       (d)  $\vec{S} = \frac{1}{\epsilon_0} (\vec{E} \times \vec{B})$

**15.** Time-Division Multiplexing

- (a) can be used with PAM only.  
(b) combines five groups into a supergroup.  
(c) stacks 24 channels in adjacent frequency slots.  
(d) interleaves pulses belonging to different transmissions.

**16.** One of the following types of noise becomes of great importance at high frequencies. It is the

- (a) Shot noise      (b) Random noise  
(c) Impulse noise      (d) Transit-time noise

**17.** A relaxation oscillator is one which

- (a) oscillates continuously  
(b) has two stable states  
(c) relax indefinitely  
(d) produces non-sinusoidal output

**18.** The transducer which generates electrical power

- (a) Photoconductor      (b) Photodiode  
(c) Solar cell      (d) Phototransistor

**19.** The step-index monomode fiber has diameter

- (a)  $\leq 10 \mu\text{m}$       (b)  $50 \mu\text{m}$   
(c)  $100 \mu\text{m}$       (d)  $200 \mu\text{m}$

**20.** Which control system has hysteresis property?

- (a) ON-OFF controller      (b) Proportional controller  
(c) Integral controller      (d) P-I-D controller

**Q. No(s) 21 to 30 :** The following items consist of two statements, one labelled the "Assertion (A)" and the other labelled the "Reason (R)". you are to examine these two statements carefully and decide if the Assertion (A) and the Reason (R) individually true and if so, whether the Reason is a correct explanation of the Assertion. Select your answer to these items using the code given below and mark your answer accordingly:

**Codes:**

- (a) Both (A) and (R) are true and (R) is the correct explanation of (A).  
(b) Both (A) and (R) are true, but (R) is not correct explanation of (A).  
(c) (A) is true, but (R) is false  
(d) (A) is false, but (R) is true

**21. Assertion (A):** If a semiconductor is placed in a transverse magnetic field  $B$  and an electric field  $E$  is applied across its other two faces, then it would produce an electric current  $I$ , in the direction perpendicular to both  $B$  and  $E$ .

**Reason (R):** Hall co-efficient is proportional to the mobility of charge carrier in semi-conductor.

**22. Assertion (A):** The voltage-current characteristic of tunnel diode exhibits dynamic negative resistance region.

**Reason (R):** The negative resistance occurs, therefore, tunnel diode behaves as low power oscillating device.

**23. Assertion (A):** R-2R ladder type D/A converter has a higher speed of conversion than a weighted resistance D/A converter.

**Reason (R):** R-2R ladder type D/A converter uses a smaller number of components than the weighted resistance D/A converter.

**24. Assertion (A):** A processor can reference a memory stack without specifying an address.

**Reason (R):** The address is always available and automatically updated in the stack pointer.

**25. Assertion (A):** The part of root locus on the real axis is not dependent upon the poles and zeros which are not on the real axis.

**Reason (R):** Poles and zeros which are not on the real axis always occur in conjugate pairs.



**26. Assertion (A):** The top down structured programming should be used for developing programmes.

**Reason (R):** The top down structured programming methodology enables us to get readable and easily provable program.

**27. Assertion (A):** Stimulated emission is the key to the operation of LASER.

**Reason (R):** An important property of laser radiation is its coherence, under which is meant the correlation between the phases of oscillation at different positions in space and at various moments of time.

**28. Assertion (A):** An half adder is faster than full-adder.

**Reason (R):** An half adder gives only one output while a full adder gives two outputs.

**29. Assertion (A):** A programmable Read-Only-Memory can be used as a synchronous counter.

**Reason (R):** Each memory location of a programmable Read-Only-Memory is programmed and can be read synchronously.

**30. Assertion (A):** In PCM a message signal is represented by a sequence of coded pulses, which is accomplished by representing the signal in discrete form in both time and amplitude.

**Reason (R):** The signal encoded in the form of quantized samples which translates into a coded number.

**31.** Consider the following circuit configurations:

1. Common emitter
2. Common base
3. Emitter follower
4. Emitter follower using Darlington pair

The correct sequence in increasing order of the input resistances of these configurations is

- (a) 2, 1, 4, 3                      (b) 1, 2, 4, 3  
(c) 2, 1, 3, 4                      (d) 1, 2, 3, 4

**32.** Digital measuring instruments use the following types of A to D converters:

1. Dual slope Type
2. Counter Type
3. Flash Type

The correct sequence for these converters in decreasing order of their speed (fastest to slowest) is

- (a) 3, 1, 2                      (b) 1, 2, 3  
(c) 2, 3, 1                      (d) 3, 2, 1

**33.** Consider the following logic families:

1. MOS                      2. DTL
3. RTL                      4. ECL

The sequence of the logic families in the order of their increasing noise margin is

- (a) 3, 4, 1, 2                      (b) 3, 4, 2, 1  
(c) 4, 3, 1, 2                      (d) 4, 3, 2, 1

**34.** Consider the following communication systems:

1. FM Broadcast
2. AM Broadcast
3. Microwave Communication
4. Optical Fiber Communication

The sequence of the communication systems in the order of their increasing carrier frequency is

- (a) 4, 2, 1, 3                      (b) 2, 1, 3, 4  
(c) 1, 2, 3, 4                      (d) 3, 4, 1, 2

**35.** The highest data rate can be transmitted using following cables:

1. Co-axial cable
2. Twisted-wire cable
3. Optical fiber cable

The correct sequence in the increasing order is

- (a) 1, 3, 2                      (b) 3, 1, 2  
(c) 2, 1, 3                      (d) 3, 2, 1

**36.** Match List-I with List-II and select the correct answer by using the codes given below the lists:

List-I	List-II
A. LASER	1. Spontaneous emission
B. Solar cell	2. Consumes electrical power due to the incident light
C. Photo diode	3. Delivers power to a load
D. LED	4. Stimulated emission

**Codes:**

A	B	C	D
(a) 4	3	1	2
(b) 3	4	2	1
(c) 4	3	2	1
(d) 3	4	1	2

**37.** Match List-I with List-II and select the correct answer by using the codes given below the lists:

List-I	List-II
A. BJT	1. Pinch off effect
B. FET	2. Controlled rectification
C. SCR	3. Negative resistance characteristics
D. Tunnel diode	4. Punch through effect

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	1	2	3	4
(c)	4	1	2	3
(d)	1	4	3	2

- 38.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Ampere's law	1. Force on a charge
B. Biot's law	2. Force due to a current carrying conductor
C. Coulomb's law	3. Electric flux density at a point
D. Gauss's law	4. Magnetic flux density at a point

Codes:

	A	B	C	D
(a)	3	2	1	4
(b)	4	2	1	3
(c)	4	1	2	3
(d)	3	1	2	4

- 39.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Parallel comparator	1. $n$ -bits conversion time
B. Successive approximation	2. Fastest converter
C. Dual slope	3. Voltage dependent conversion type
D. Counter type	4. Integrating type

Codes:

	A	B	C	D
(a)	2	1	3	4
(b)	2	1	4	3
(c)	1	2	4	3
(d)	1	2	3	4

- 40.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Frequency modulation	1. Junctionless device
B. Double sideband suppressed	2. Single junction device
C. PCM	3. Double junction device
D. Amplitude modulation	4. Triple junction device

- Envelope detection
- Companding suppressed
- Balance modulator
- Pre-emphasis and de-emphasis

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	1	2	4	3
(c)	4	3	1	2
(d)	4	3	2	1

- 41.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. LVDT	1. Pressure
B. Bourdon tube	2. Temperature
C. Strain gauge	3. Displacement
D. Thermistor	4. Stress

Codes:

	A	B	C	D
(a)	4	3	2	1
(b)	3	2	1	4
(c)	4	1	3	2
(d)	3	1	4	2

- 42.** Match **List-I (Flags)** with **List-II (Bit position)** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Sign flag	1. 4 <sup>th</sup> bit
B. Parity	2. 6 <sup>th</sup> bit
C. Zero	3. 2 <sup>nd</sup> bit
D. Auxiliary	4. 7 <sup>th</sup> bit

Codes:

	A	B	C	D
(a)	1	3	2	4
(b)	4	3	2	1
(c)	1	4	3	2
(d)	2	1	3	4

- 43.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

List-I	List-II
A. Gunn diode	1. Junctionless device
B. Solar cell	2. Single junction device
C. MOSFET	3. Double junction device
D. SCR	4. Triple junction device

**Codes:**

	A	B	C	D
(a)	4	1	2	3
(b)	3	4	1	2
(c)	1	2	3	4
(d)	2	3	1	4

- 44.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

**List-I**

- A. Monostable multivibrator
- B. Astable multivibrator
- C. Schmitt trigger
- D. Bistable multivibrator

**List-II**

- 1. Quasi stable state
- 2. One stable state
- 3. Two stable state
- 4. No stable state

**Codes:**

	A	B	C	D
(a)	1	2	4	3
(b)	2	4	1	3
(c)	3	1	2	4
(d)	4	1	2	3

- 45.** Match **List-I** with **List-II** and select the correct answer by using the codes given below the lists:

**List-I**

- A. Semi-conductor memory
- B. Ferrite core memory
- C. Magnetic tape memory
- D. Flash memory

**List-II**

- 1. Destructive read out
- 2. Combinational logic
- 3. Non-volatile
- 4. EEPROM

**Codes:**

	A	B	C	D
(a)	2	1	3	4
(b)	1	2	4	3
(c)	2	3	1	4
(d)	4	2	1	3

Read the paragraph and answer the question **46 to 50**:

Noise may be defined, in an electrical sense, as an unwanted form of energy tending to interfere with the proper and easy reception and reproduction of wanted signals.

Many disturbances of the electrical nature produce noise in receiver, modifying the signal in an unwanted manner. Noise is divided into two groups. Noise whose sources are external to the receiver and other one is noise created within the receiver itself. Various forms of noise created outside the receiver i.e. external noise includes atmospheric and extra-terrestrial noise and industrial noise. Atmospheric noise becomes less severe at frequencies above 30 MHz. Extra-terrestrial noises are solar noise and cosmic noise. They radiate over a very broad frequency spectrum which includes the frequencies, we use for communication. These disturbances are at the eruption of corona flares and sunspots. The noise generated is due to the random motion of electrons, atoms and molecules. Kinetic theory states that the temperature of the system increases due to the motion of the particles.

- 46.** In a communication system, noise is most likely to affect the signal

- (a) at a transmitter
- (b) in a channel
- (c) in the information source
- (d) at the destination

- 47.** Indicate the false statement.

- (a) HF mixers are generally noisier than HF amplifiers.
- (b) Impulse noise voltage is independent of bandwidth.
- (c) Thermal noise is independent of the frequency at which it is measured.
- (d) Industrial noise is usually of the impulse type.

- 48.** The value of a resistor creating thermal noise is doubled. The noise power generated is therefore

- (a) halved
- (b) quadrupled
- (c) doubled
- (d) unchanged

- 49.** One of the following is not a useful quantity for comparing the noise performance of receivers:

- (a) Input noise voltage
- (b) Equivalent noise resistance
- (c) Noise temperature
- (d) Noise figure

- 50.** Indicate the noise whose source is in a category different from that of the other three.

- (a) Solar noise
- (b) Cosmic noise
- (c) Atmospheric noise
- (d) Galactic noise

**Answers UGC NET Paper-II : June-2012**

1. (b) 2. (c) 3. (c) 4. (d) 5. (b) 6. (a) 7. (c) 8. (c) 9. (d) 10. (b)  
 11. (a) 12. (d) 13. (c) 14. (a) 15. (d) 16. (d) 17. (d) 18. (c) 19. (a) 20. (d)  
 21. (b) 22. (c) 23. (a) 24. (a) 25. (a) 26. (a) 27. (a) 28. (c) 29. (c) 30. (a)  
 31. (c) 32. (d) 33. (b) 34. (b) 35. (b) 36. (c) 37. (c) 38. (b) 39. (b) 40. (d)  
 41. (d) 42. (b) 43. (c) 44. (b) 45. (a) 46. (b) 47. (b) 48. (d) 49. (a) 50. (c)

**Explanations UGC NET Paper-II : June-2012****1. (b)**

In a JFET, the change in drain current is due to the applied electric field between Gate (G) and Source (S).

$$\text{Drain current, } I_D = I_{DSS} \left[ 1 - \frac{V_{GS}}{V_p} \right]^2.$$

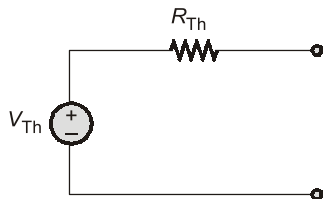
**2. (c)**

In case of metals, with increase in temperature the atoms start vibrating and thus offer resistance to the flow of electrons. Hence, the electrical conductivity decreases.

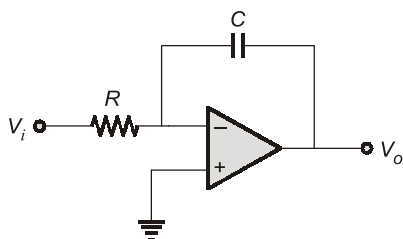
In case of semiconductors, with increase in temperature, the mobility of electrons increases and electrons start shifting from valence band to conduction band, hence its conductivity increases.

**4. (d)**

Thevenin's theorem:

**5. (b)**

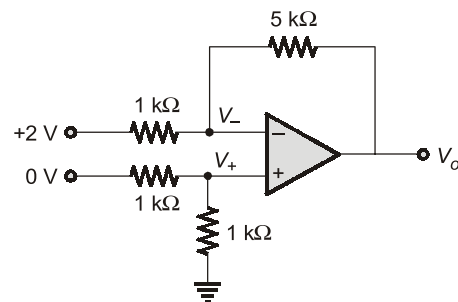
Op-amp integrator can be drawn as,



$$\therefore V_o = -\frac{1}{RC} \int V_i dt$$

**6. (a)**

Given op-amp circuit,



Since it is an ideal op-amp,

$$V_+ = V_- \\ V_+ = 0V = V_-$$

At inverting terminal,

$$\frac{V_- - 2}{1k\Omega} + \frac{V_- - V_o}{5k\Omega} = 0$$

$$5V_- - 10 + V_- - V_o = 0$$

$$6V_- - 10 = V_o$$

$$\therefore V_o = -10V$$

**7. (c)**

For a binary counter to count 0 to 1023, number of flip-flops required

$$2^n \leq 1024$$

$$\therefore n = 10$$

**8. (c)**

Integrating type analog-to-digital converter is slowest ADC.

**9. (d)**

In a microprocessor, WAIT states are used to interface slow peripherals to the processor.

**10. (b)**

Program counter holds the address of the next instruction to be fetched.

**12. (d)**

Tree is a form of data structure where the data elements don't stay arranged linearly or sequentially.

**13. (c)**

Poisson's equation,  $\nabla^2 V = -\frac{\rho}{\epsilon}$ .

**14. (a)**

The energy per unit time, per unit area transported by electromagnetic fields is expressed as

$$\vec{S} = \frac{1}{\mu_0} (\vec{E} \times \vec{B})$$

**16. (d)**

Transit-time noise is of great importance at high frequencies.

**17. (d)**

Relaxation oscillator produces non-sinusoidal output.

**18. (c)**

Solar cell generates electrical power output.

**19. (a)**

The step-index monomode fiber has core diameter between 8 to 10.5  $\mu\text{m}$ .

**20. (d)**

P-I-D control system has hysteresis property.

**21. (b)**

Hall coefficient,  $R_H = \mu\sigma$ .

**28. (c)**

Half adder gives two outputs i.e., sum and carry.

**31. (c)**

The correct sequence of increasing order of the input resistances are CB, CE, Emitter follower (CC), Darlington pair.

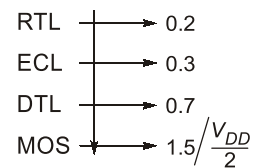
**32. (d)**

Decreasing order of speed:

Flash type

Counter type

Dual slope type

**33. (b)****42. (b)**

Flag register:

$D_7$	$D_6$	$D_5$	$D_4$	$D_3$	$D_2$	$D_1$	$D_0$
S	Z		AC		P		CY

S = Sign; P = Parity; AC = Auxiliary Carry  
CY = Carry

**46. (b)**

In a communication system, noise is most likely to affect the signal in a channel.

**47. (b)**

Impulse noise voltage is occurs for low duration means large bandwidth.

**48. (d)**

Thermal noise power,

$$P_n = kTB$$

$\therefore P_n$  is independent on R.