



**Maratha Vidya Prasarak Samaj's**

**Rajarshi Shahu Maharaj Polytechnic, Nashik**

**Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.**

**Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.**

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***Subject: - Basic Electronics  
(22225)***



# SYLLABUS

<b>Chapter No.</b>	<b>Name of chapter</b>	<b>Marks With Option</b>
<b>1</b>	<b>Electronic components and Signals</b>	<b>10</b>
<b>2</b>	<b>Diode and their Applications</b>	<b>26</b>
<b>3</b>	<b>Bipolar Junction Transistor</b>	<b>26</b>
<b>4</b>	<b>Filed Effect Transistors</b>	<b>16</b>
<b>5</b>	<b>Sensors and Transducers</b>	<b>24</b>
<b>Total Marks:-</b>		<b>102</b>

# BOARD THEORY PAPER PATTERN FOR BEC (22225)

<b>Q.1</b>		<b>Attempt any FIVE</b>	<b>5*2=10</b>
	a)	Electronic components and Signals	
	b)	Filed Effect Transistors	
	c)	Diode and their Applications	
	d)	Sensors and Transducers	
	e)	Bipolar Junction Transistor.	
	f)	Sensors and Transducers	
	g)	Diode and their Applications	
<b>Q.2</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Bipolar Junction Transistor.	
	b)	Electronic components and Signals.	
	c)	Filed Effect Transistors.	
	d)	Diode and their Applications.	
<b>Q.3</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Filed Effect Transistors.	
	b)	Diode and their Applications	
	c)	Sensors and Transducers.	
	d)	Electronic components and signals	
<b>Q.4</b>		<b>Attempt any THREE</b>	<b>3*4=12</b>
	a)	Diode and their Applications.	
	b)	Bipolar Junction Transistor.	
	c)	Diode and their Applications.	
	d)	Sensors and Transducers	



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	e)	Bipolar Junction Transistor.
<b>Q.5</b>		<b>Attempt any TWO <span style="float: right;">2*6=12</span></b>
	a)	Sensors and Transducers
	b)	Diode and their Applications
	c)	Bipolar Junction Transistor
<b>Q.6</b>		<b>Attempt any TWO <span style="float: right;">2*6=12</span></b>
	a)	Sensors and Transducers
	b)	Bipolar Junction Transistor
	c)	Filed Effect Transistors





# CLASS TEST - I

## PAPER PATTERN

### Syllabus:-

Unit No.	Name of the Unit	Course Outcome (CO)
1	Electronic components and Signals	CO225.1
2	Diode and their Applications	CO225.2
3	Bipolar Junction Transistor	CO225.3

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Electronic components and Signals		CO225.1
b)	Diode and their Applications		CO225.2
c)	Diode and their Applications		CO225.2
d)	Bipolar Junction Transistor		CO225.3
e)	Electronic components and Signals		CO225.1
f)	Bipolar Junction Transistor		CO225.3
Q.2	Attempt any THREE	3*4=12Marks	
a)	Electronic components and Signals		CO225.1
b)	Diode and their Applications		CO225.2
c)	Diode and their Applications		CO225.2
d)	Bipolar Junction Transistor.		CO225.2
e)	Electronic components and Signals		CO225.1
f)	Bipolar Junction Transistor		CO225.3



# CLASS TEST - II

## PAPER PATTERN

Unit No.	Name of the Unit	Course Outcome (CO)
3	Bipolar Junction Transistor	CO225.3
4	Filed Effect Transistors	CO225.4
5	Sensors and Transducers	CO225.5

Q.1	Attempt any FOUR	4*2=8Marks	Course Outcome (CO)
a)	Sensors and Transducers		CO225.5
b)	Filed Effect Transistors.		CO225.4
c)	Bipolar Junction Transistor		CO225.3
d)	Filed Effect Transistors		CO225.4
e)	Sensors and Transducers		CO225.5
f)	Filed Effect Transistors.		CO225.4
Q.2	Attempt any THREE	3*4=12Marks	
a)	Filed Effect Transistors		CO225.4
b)	Sensors and Transducers		CO225.5
c)	Filed Effect Transistors		CO225.4
d)	Bipolar Junction Transistor		CO225.3
e)	Sensors and Transducers		CO225.5
f)	Bipolar Junction Transistor		CO225.3



# **COURSE OUTCOME**

## **(CO)**

**COURSE:- Basic Electronics (22225)**

**PROGRAMME: - CM**

<b>CO. NO</b>	<b>Course Outcome</b>
<b>CO-225.1</b>	Identify electronic component in electronic circuit
<b>CO-225.2</b>	Use diode in different application
<b>CO-225.3</b>	Interpret the working of junction transistor in electronic circuit
<b>CO-225.4</b>	Interpret the working of Unipolar devices in electronic circuit
<b>CO-225.5</b>	Use sensors and transducers



# 1. Electronic components and Signals

Position in Question Paper

Total Marks - 10

Q.1. a) 2-Marks.

Q.2. b) 4-Marks.

Q.3. d) 4-Marks.

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## Descriptive Questions

1. Draw the symbol of Inductor and Capacitor
2. Define active components and passive components
3. List any four specifications of resistors
4. List the types of signals
5. Draw the symbol of inductor and capacitor. State the unit of inductor and capacitor.
6. State the two advantages and disadvantages of integrated circuits
7. Give four differences between analog and digital circuits.
8. State the advantages of integrated circuits over circuits with discrete components.
9. Determine the value of resistance with following colour code:
  - i.Red, Red, Orange, Gold
  - ii.Brown, Black, Black, Silver
10. Determine the value of capacitance with the following colour code.
  - i.Orange, Orange, Blue
  - ii.Yellow, Violet, Yellow

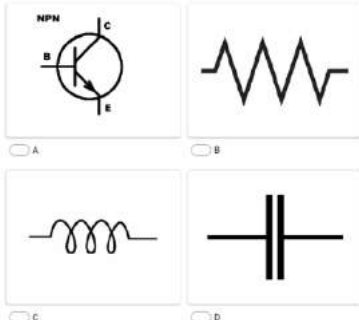


## MCQ Question


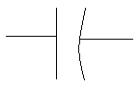


(Total number of Question=Marks\*3=12\*3=36)

Note: Correct answer is marked with **bold**.

- Out of following which is not a type of passive component:
  - Resistor
  - Capacitor
  - FET**
  - Inductor
- The property of opposition to change in flow of current is known as \_\_\_\_\_
  - Capacitance
  - Resistance**
  - Conductance
  - Inductance
- Calculate the value of resistance of following color code resistance: RED RED ORANGE GOLD
  - 1.2 K Ohm
  - 470 Ohm
  - 97 K Ohm
  - 22 K Ohm**
- Out of following is not a type of capacitor:
  - Ceramic Capacitor
  - Mica Capacitor
  - Wire wound**
  - Electrolytic Capacitor
- Out of following which is not a advantage of Integrated circuit:
  - Small size and weight
  - High reliability
  - High speed
  - High initial cost**
- Identify the symbol of Inductor:



- The number of cycle of waveform per second is defined as \_\_\_\_\_.
  - Frequency**
  - Time period
  - Amplitude
  - Wavelength
- An active device is one which \_\_\_\_\_.
  - Mechanically controls electron flow
  - Electrically controls electron flow**
  - Pneumatically controls electron flow
  - Automatically controls electron flow
- Which of the following elements comprise of the passive devices?
  - Resistors, Capacitors and SCRs
  - Vacuum Tubes, SCRs and Diodes
  - Transformers, Inductors and Diodes**

- d) Transformers, TRIACs and DIACs
10. A transistor is a current controlled device because \_\_\_\_\_
- In the base region movement of charge carrier is because of the electrons which are minority charge carrier in the base region**
  - In the collector region movement of charge carrier is because of the electrons which are minority charge carrier in the collector region
  - In the base region movement of charge carrier is because of the holes which are majority charge carrier in the base region
  - In the collector region movement of charge carrier is because of the holes which are majority charge carrier in the base region
11. Active devices can also be used as \_\_\_\_\_
- Amplifiers**
  - Choppers
  - Converter
  - Inverters
12. How do amplifiers work without violating Law of Conservation of Energy?
- They amplify one factor of the input and reduce others
  - They work on the law of conservation of mass
  - They violate the Law of Conservation of Energy
  - They amplify the signal by taking an input from an external source**
13. The symbol used for capacitance is \_\_\_\_\_
- 
  - 
  - 
  - 
14. The formula used to find the capacitance C is \_\_\_\_\_
- $Q/v$**
  - $Qv$
  - $Q-v$
  - $Q + v$
15. The capacitor doesn't allow sudden changes in \_\_\_\_\_
- Voltage**
  - Current
  - Resistance
  - Capacitance
16. The Inductor doesn't allow sudden changes in \_\_\_\_\_
- Voltage
  - Current**
  - Resistance
  - Inductance
17. The expression for energy of an inductor \_\_\_\_\_
- $\frac{1}{2} LI$
  - $L/2I$
  - $\frac{1}{2} L^2I$
  - $\frac{1}{2} LI$**
18. The units for inductance is \_\_\_\_\_ and capacitance is \_\_\_\_\_
- Faraday, Henry
  - Coulomb, Faraday
  - Henry, Faraday**
  - Henry, Coulomb
19. If a capacitor of capacitance 9.2F has a voltage of 22.5V across it. Calculate the



- energy of the capacitor.
- a) 5062.5W  
**b) 506.25W**
- c) 50.625W  
d) 50625W
20. If the voltage across a capacitor is constant, then current passing through it is
- a) 1  
**b) 0**
- c) -1  
d) Infinity
21. Inductor works as a \_\_\_\_\_ circuit for DC supply.
- a) Open  
**b) Short**
- c) Polar  
d) Non-polar
22. The insulating medium between the two plates of capacitor is known as
- a) Electrode  
b) capacitive medium
- c) Conducting medium  
**d) Dielectric**
23. Two capacitors, each of 220  $\mu\text{F}$ , are connected in parallel. The capacitance of the combination will be:
- a) 110 $\mu\text{F}$   
b) 220 $\mu\text{F}$
- c) **440 $\mu\text{F}$**   
d) 420mf
24. If the resistance of a material falls with increasing temperature it is said to have:
- a) negative temperature coefficient**  
b) positive temperature coefficient  
c) zero temperature coefficient  
d) variable temperature coefficient
25. The circuit symbol shown is a:
- a) fixed resistor  
b) preset resistor
- c) variable resistor  
d) temperature resistor
26. Two capacitors, each of 15  $\mu\text{F}$ , are connected in series. The capacitance of the combination will be:
- a) **7.5 $\mu\text{F}$**   
b) 15 $\mu\text{F}$
- c) 30 $\mu\text{F}$   
d) 4.5mF
27. The fourth band of a four band resistor is marked in silver. This indicates a tolerance of:
- a) 5%  
**b) 10%**
- c) 20%  
d) 40%
28. The primary and secondary voltages present in a loss-free transformer are 240 V and 12 V respectively. If the secondary is connected to a 6  $\Omega$  resistor, which one of the following gives the primary current?
- a) 100 mA**  
b) 20 A
- c) 2 A  
d) 5mA
29. The third band of a four band resistor is marked in black. This indicates a multiplier of:
- a) 1**  
b) 10
- c) 100  
d) 1000



30. Two inductors, each of 6.8 mH, are connected in parallel. The inductance of the combination will be:
- a) **3.4 mH**
  - b) 6.8 mH
  - c) mH
  - d) 34mH
31. A loss-free transformer has 1200 primary turns and 300 secondary turns. If the primary winding is connected to a 200 V AC supply which one of the following gives the secondary voltage:
- a) **50 V**
  - b) 900 V
  - c) 800 V
  - d) 15 V
32. A 100 nF capacitor has a tolerance of  $\pm 5\%$ . The maximum possible value for this component will be:
- a) 95 nF
  - b) **105 nF**
  - c) 110 nF
  - d) 58nF
33. The resistance of a light dependent resistor:
- a) **falls with increasing light level**
  - b) increases with increasing light level
  - c) remains constant irrespective of light level
  - d) increases with decreasing light level
34. Two resistors, each of 15  $\Omega$ , are connected in series. The resistance of the combination will be:
- a) 7.5 $\Omega$
  - b) 5 $\Omega$
  - c) **30 $\Omega$**
  - d) 8 $\Omega$
35. A graph of charge, Q, plotted against voltage, V, for a capacitor will take the form of:
- a) a curve that rises rapidly
  - b) a curve that falls rapidly
  - c) **a straight line.**
  - d) a exponential line
36. The third band of a four band resistor is marked in orange. This indicates a multiplier of:
- a) **1,000**
  - b) 100,000
  - c) 10,000
  - d) 150,000



## 2. Diode and their Applications

Position in Question Paper

Total Marks - 26

Q.1. c) 2-Marks.

Q.1. g) 2-Marks.

Q.2. d) 4-Marks.

Q.3. b) 4-Marks.

Q.4. a) 4-Marks.

Q.4. c) 4-Marks

Q.5. b) 6-Marks.

### Descriptive Questions

1. Write two applications of P-N junction diode
2. State the need of filters in a regulated DC power supply
3. Define  $\alpha$  and  $\beta$  of transistor.
4. Draw the symbol of P-N junction diode & Zener diode
5. Define PIV, Ripple factor, Efficiency
6. Draw the diagram of  $\pi$  filter
7. Draw and describe working principle of LED.
8. Draw and explain zener diode as a voltage regulator.
9. Sketch the block diagram of regulated power supply. Draw the waveforms at the output of each block.
10. Explain the working of P-N junction diode
11. Draw & explain the working of full wave rectifier circuit
12. Draw & explain the working of Half wave rectifier circuit
13. Describe the working of LC filter
14. Explain the working principle of  $\pi$  filter
15. Compare between the Zener diode and P-N junction diode
16. Draw the V-I characteristics of P-N junction diode
17. Draw & explain the working of bridge rectifier circuit.



## MCQ Question

(Total number of Question=Marks\*3=16\*3=48)

Note: Correct answer is marked with **bold**.

- The forward voltage drop across a silicon diode is about \_\_\_\_\_
  - 2.5 V
  - 3 V
  - 10 V
  - 0.7 V**
- A transistor has \_\_\_\_\_ PN junctions.
  - One
  - Two**
  - Three
  - Four
- Main use of Zener diode is in which biasing mode?
  - Forward Biasing
  - Reverse Biasing**
  - Both
  - None of the above
- Total number of diodes used in Bridge full wave rectifier is \_\_\_\_\_.
  - 1
  - 2
  - 3
  - 4**
- Out of following which material is not used in combination of manufacturing LEDs.
  - Gallium
  - Arsenide
  - Phosphate
  - Germanium**
- Out of following, which one isn't a type of rectifier?
  - Precision Half-wave Rectifier
  - Bridge Rectifier
  - Peak Rectifier**
  - Centre tapped Rectifier
- In a full wave rectifier, if the input frequency is 50 Hz, then output frequency will be
  - 50 Hz
  - 75 Hz
  - 100 Hz**
  - 200 Hz
- \_\_\_\_\_ is not a type of filter component in regulated power supply circuit.
  - Shunt C Filter
  - Series L Filter
  - LC Filter
  - Transistor**
- Except transformer, the main parts of regulated power supply are \_\_\_\_\_.
  - Filter and Regulator
  - Filter and transistor
  - Transistor and Regulator
  - Rectifier, Filter and Transistor**
- The AC components are filtered most to produce pure DC by which of the following filter?
  - C-L-C Filter**
  - Shunt Capacitor
  - Series Inductor
  - L-C Filter
- In P-N-P transistor, base will be of \_\_\_\_\_ material.
  - P material
  - N material**
  - Either of the above
  - None of the above
- The base current amplification factor  $\beta$  is given by \_\_\_\_\_.
  - IB/IC
  - IE/IB**



- c) IB/IE d) IC/IB
13. The relation between  $\alpha$  and  $\beta$  is \_\_\_\_\_ .
- a)  $\beta = \alpha / (1-\alpha)$  c)  $\beta = \alpha / (1+\alpha)$   
b)  $\alpha = \beta / (1+\beta)$  d)  $\alpha = \beta / (1-\beta)$
14. Consider a peak rectifier fed by a 60-Hz sinusoid having a peak value  $V_p = 100$  V.  
Let the load resistance  $R = 10$  k $\Omega$ . Calculate the fraction of the cycle during which the diode is conducting
- a) 1.06 % c) **3.18%**  
b) 2.12 % d) 4.24%
15. Ageing of a selenium rectifier may change the output voltage by \_\_\_\_\_ .
- a) **5 to 10%** c) 25 to 30%  
b) 15 to 20% d) None of the above
16. Which off the following rectifiers are primarily used for charging of low-voltage batteries from AC supply?
- a) Mechanical rectifiers c) Selenium rectifiers  
b) Copper oxide rectifiers d) **Electrolytic rectifiers**
17. The diode in a half wave rectifier has a forward resistance  $R_F$ . The voltage is  $V_m \sin \omega t$  and the load resistance is  $R_L$ . The DC current is given by \_\_\_\_\_
- a)  $V_m / \sqrt{2} R_L$  c)  $2V_m / \sqrt{\pi}$   
b)  $V_m / (R_F + R_L) \pi$  d)  $V_m / R_L$
18. In a half wave rectifier, the sine wave input is  $50 \sin 50t$ . If the load resistance is of 1K, then average DC power output will be?
- a) 3.99V c) 5.97V  
b) **2.5V** d) 6.77V
19. In a half wave rectifier, the sine wave input is  $200 \sin 300t$ . The average value of output voltage is?
- a) 57.876V c) **63.694V**  
b) 67.453V d) 76.987V
20. Efficiency of a half wave rectifier is \_\_\_\_\_ .
- a) 50% c) **40.6%**  
b) 60% d) 46%
21. If peak voltage for a half wave rectifier circuit is 5V and diode cut in voltage is 0.7, then peak inverse voltage on diode will be?
- a) 5V c) **4.3V**  
b) 4.9V d) 6.7V
22. Transformer utilisation factor of a half wave rectifier is \_\_\_\_\_ .
- a) 0.234 c) **0.287**  
b) 0.279 d) 0.453
23. If the input frequency of a half wave rectifier is 100Hz, then the ripple frequency will be \_\_\_\_\_ .



- a) 150Hz  
b) 200Hz
- c) **100Hz**  
d) 300Hz
24. Ripple factor of a half wave rectifier is \_\_\_\_\_  $I_m$  is the peak current and  $R_L$  is load resistance \_\_\_\_\_ .
- a) 1.414  
b) **1.21**  
c) 1.4  
d) 0.48
25. Efficiency of a centre tapped full wave rectifier is \_\_\_\_\_
- a) 50%  
b) 46%  
c) 70%  
d) **81.2%**
26. A full wave rectifier supplies a load of  $1K\Omega$ . The AC voltage applied to diodes is 220V (rms). If diode resistance is neglected, what is the ripple voltage?
- a) 0.562V  
b) 0.785V  
c) **0.954V**  
d) 0.344V
27. A full wave rectifier delivers 50W to a load of  $200\Omega$ . If the ripple factor is 2%, calculate the AC ripple across the load.
- a) **2V**  
b) 5V  
c) 4V  
d) 1V
28. A full wave rectifier uses load resistor of  $1500\Omega$ . Assume the diodes have  $R_f=10\Omega$ ,  $R_r=\infty$ . The voltage applied to diode is 30V with a frequency of 50Hz. Calculate the AC power input.
- a) 368.98mW  
b) **275.2mW**  
c) 145.76mW  
d) 456.78mW
29. If input frequency is 50Hz for a full wave rectifier, the ripple frequency of it would be \_\_\_\_\_
- a) **100Hz**  
b) 50Hz  
c) 25Hz  
d) 500Hz
30. Transformer utilization factor of a centre tapped full wave rectifier is \_\_\_\_\_
- a) 0.623  
b) 0.678  
c) **0.693**  
d) 0.625
31. If the peak voltage on a centre tapped full wave rectifier circuit is 5V and diode cut in voltage is 0.7. The peak inverse voltage on diode is \_\_\_\_\_
- a) 4.3V  
b) **9.3V**  
c) 5.7V  
d) 10.7V
32. In a centre tapped full wave rectifier, the input sine wave is  $250\sin 100t$ . The output ripple frequency will be \_\_\_\_\_
- a) **50Hz**  
b) **100Hz**  
c) 25Hz  
d) 200Hz
33. DC average current of a bridge full wave rectifier (where  $I_m$  is the maximum peak current of input).









## 3. Bipolar Junction Transistor

Position in Question Paper

Total Marks-26

Q.1. e) 2-Marks.

Q.2. a) 4-Marks.

Q.4. b) 4-Marks.

Q.4. e) 4-Marks

Q.5. c) 6-Marks.

Q.6. b) 6-Marks.

### Descriptive Questions

1. Classify the Unipolar & bipolar devices
2. Draw the symbol of NPN & PNP transistor
3. Define  $\alpha$  and  $\beta$  of transistor
4. Draw the output characteristics of CE configuration.
5. List the type of transistor and draw their symbols
6. Draw & explain the NPN transistor
7. Explain the construction of NPN transistor
8. Describe the working of PNP transistor
9. Describe the working of transistors a switch with circuit diagram.
10. Draw & explain the V-I characteristics of CE Configuration
11. Explain the relation in between  $\alpha$  and  $\beta$ .
12. Define input & output resistance of transistor.
13. Explain the working of two stage RC coupled amplifier
14. Draw and explain voltage divider bias network
15. Derive the relation between  $\alpha$  and  $\beta$  of a transistor.
16. Comparison in between CE, CB and CC
17. Explain the concept of DC load line and operating point for biasing circuit.



## MCQ Question

(Total number of Question=Marks\*3=18\*3=54)

Note: Correct answer is marked with **bold**.

- In transformer coupled amplifier, coupling takes place using \_\_\_\_\_.
  - Capacitor
  - Single Wire
  - Transformer**
  - RC Network
- The colour code for 680  $\mu\text{H}$  inductor with  $\pm 5\%$  tolerance is:
  - Blue Grey Brown Gold
  - Black Grey Brown Gold
  - Orange Grey Brown Gold**
  - Red Grey Brown Gold
- The typical value of the current gain of a common-base configuration is \_\_\_\_\_.
  - Less than 1**
  - Between 1 and 50
  - Between 100 and 200
  - Undefined
- The doping concentration of which terminal of BJT transistor is highest?
  - Base
  - Emitter**
  - Collector
  - Same for all terminals
- The current gain of common base configuration is denoted by \_\_\_\_\_.
  - Beta
  - Gama
  - Alpha**
  - Zeta
- Which of the following is not a part of a BJT?
  - Base
  - Collector
  - Emitter
  - None of the mentioned**
- The number of pn junctions in a BJT is/are
  - 1
  - 2**
  - 3
  - 4
- In which of the following modes can a BJT be used?
  - Cut-off mode
  - Active mode
  - Saturation mode
  - All of the mentioned**
- If a BJT is to be used as an amplifier, then it must operate in \_\_\_\_\_.
  - Cut-off mode
  - Active mode**
  - Saturation mode
  - All of the mentioned
- If a BJT is to be used as a switch, it must operate in \_\_\_\_\_.
  - Cut-off mode or active mode
  - Active Mode or saturation mode
  - Cut-off mode or saturation mode**
  - Cut-off mode or saturation mode or active mode
- On which of the following does the scale current not depends upon?
  - Effective width of the base
  - Charge of an electron



- c) Electron diffusivity  
**d) Volume of the base-emitter junction**
12. On which of the following does the collector current not depend upon?  
a) Saturation current  
b) Thermal voltage  
c) Voltage difference between the base and emitter  
**d) None of the mentioned**
13. The range for the transistor parameter also referred as common-emitter current gain has a value of \_\_\_\_\_ for common devices.  
a) **50-200** c) 750-1000  
b) 400-600 d) > 1000
14. The curve between the collector current versus the potential difference between the base and emitter is  
a) A straight line inclined to the axes  
b) A straight line parallel to the x-axis  
**c) An exponentially varying curve**  
d) A parabolic curve
15. The curve between the collector current and the saturation is  
**a) A straight line inclined to the axes**  
b) A straight line parallel to the x-axis  
c) A straight line parallel to the y-axis  
d) An exponential curve
16. The correct relation between the transistor parameters  $\alpha$  and  $\beta$  are related by  
a)  $\beta = 1 - \alpha/\alpha$  c)  $\alpha = \beta + 1/\beta$   
b)  $\beta = 1 + \alpha/\alpha$  **d)  $\alpha = \beta/\beta + 1$**
17. The correct expression relating the emitter current  $I_e$  to the collector current  $I_c$  is  
a)  $I_e = \alpha I_c$  c)  $I_e = \beta I_c$   
**b)  $I_c = \alpha I_e$**  d)  $I_c = \beta I_e$
18. The value of the thermal voltage at room temperature can be approximated as  
**a) 25 mV** c) 35 mV  
b) 30 mV d) 40 mV
19. The correct relation between the emitter current  $I_e$  and the base current  $I_b$  is given by  
a)  $I_b = (1 + \alpha) I_e$  c)  $I_e = (1 - \beta) I_b$   
b)  $I_b = (\alpha - 1) I_e$  **d)  $I_e = (1 + \beta) I_b$**
20. The Early Effect is also called as \_\_\_\_\_.  
**a) Base-width modulation effect** c) Both of the mentioned  
b) Base-width amplification effect d) None of the mentioned
21. For the BJT to operate in active mode Collector-Base junction must be  
a) Heavily doped c) Must be forward bias  
**b) Must reversed bias** d) Lightly doped



22. Which of the following condition is true for cut-off mode?
- a) The collector current is zero**
  - b) The collector current is proportional to the base current
  - c) The base current is non zero
  - d) All of the mentioned
23. Which of the following is true for the cut-off region in an npn transistor?
- a) Potential difference between the emitter and the base is smaller than 0.5V
  - b) Potential difference between the emitter and the base is smaller than 0.4V**
  - c) The collector current increases with the increase in the base current
  - d) The collector current is always zero and the base current is always non zero
24. Which of the following is true for a typical active region of an npn transistor?
- a) The potential difference between the emitter and the collector is less than 0.5 V
  - b) The potential difference between the emitter and the collector is less than 0.4 V
  - c) The potential diff. between the emitter and the collector is less than 0.3 V**
  - d) The potential difference between the emitter and the collector is less than 0.2 V
25. Which of the following is true for the active region of an npn transistor?
- a) The collector current is directly proportional to the base current
  - b) The potential difference between the emitter and the collector is less than 0.4 V
  - c) All of the mentioned**
  - d) None of the mentioned
26. Which of the following is true for the saturation region of BJT transistor?
- a) The collector current is inversely proportional to the base current
  - b) The collector current is proportional to the square root of the collector current**
  - c) The natural logarithm of the collector current is directly proportional to the base current
  - d) None of the mentioned
27. Which of the following is true for a npn transistor in the saturation region?
- a) The potential difference between the collector and the base is approximately 0.2V
  - b) The potential difference between the collector and the base is approximately 0.3V**
  - c) The potential difference between the collector and the base is approximately 0.4V
  - d) The potential difference between the collector and the base is approximately 0.5V
28. The potential difference between the base and the collector  $V_{cb}$  in a pnp transistor in saturation region is \_\_\_\_\_
- a) -0.2 V
  - b) -0.5V**
  - c) 0.2 V
  - d) 0.5 V
29. For a pnp transistor in the active region the value of  $V_{ce}$  (potential difference



between the collector and the base) is

- a) **Less than 0.3V**
  - b) Less than 3V
  - c) Greater than 0.3V
  - d) Greater than 3V
30. Which of the following is true for a pnp transistor in active region?
- a) **CB junction is reversed bias and the EB junction is forward bias**
  - b) CB junction is forward bias and the EB junction is forward bias
  - c) CB junction is forward bias and the EB junction is reverse bias
  - d) CB junction is reversed bias and the EB junction is reverse bias
31. Which of the following is true for a pnp transistor in saturation region?
- a) CB junction is reversed bias and the EB junction is forward bias
  - b) **CB junction is forward bias and the EB junction is forward bias**
  - c) CB junction is forward bias and the EB junction is reverse bias
  - d) CB junction is reversed bias and the EB junction is reverse bias
32. Find the maximum allowed output negative swing without the transistor entering saturation, and \_\_\_\_\_.
- a) 1.27 mV
  - b) 1.47 mV
  - c) 1.67 mV
  - d) **1.87 mV**
33. Which of the following condition is true for cut-off mode?
- a) **The collector current Is zero**
  - b) The collector current is proportional to the base current
  - c) The base current is non zero
  - d) All of the mentioned
34. Which of the following is true for the active region of an npn transistor?
- a) The collector current is directly proportional to the base current
  - b) The potential difference between the emitter and the collector is less than 0.4 V
  - c) **All of the mentioned**
  - d) None of the mentioned
35. The potential difference between the base and the collector  $V_{cb}$  in a pnp transistor in saturation region is \_\_\_\_\_
- a) -0.2 V
  - b) **-0.5V**
  - c) 0.2 V
  - d) 0.5 V
36. A pnp transistor in the active region the value of  $V_{ce}$  (potential difference between the collector and the base) is
- a) **Less than 0.3V**
  - b) Less than 3V
  - c) Greater than 0.3V
  - d) Greater than 3V
37. Which of the following is true for a pnp transistor in active region?
- a) **CB junction is reversed bias and the EB junction is forward bias**
  - b) CB junction is forward bias and the EB junction is forward bias
  - c) CB junction is forward bias and the EB junction is reverse bias
  - d) CB junction is reversed bias and the EB junction is reverse bias
38. Which of the following is true for a pnp transistor in saturation region?



- a) CB junction is reversed bias and the EB junction is forward bias  
b) **CB junction is forward bias and the EB junction is forward bias**  
c) CB junction is forward bias and the EB junction is reverse bias  
d) CB junction is reversed bias and the EB junction is reverse bias
39. A transistor has how many doped regions?  
a) 1  
b) 2  
c) **3**  
d) 4
40. One of important application of transistor is \_\_\_\_\_.  
a) **Amplification**  
b) Emits light  
c) Voltage regulator  
d) Line regulator
41. When transistors are used in digital circuits they usually operate in the:  
a) active region  
b) breakdown region  
c) **saturation and cutoff regions**  
d) linear region
42. Three different Q points are shown on a dc load line. The upper Q point represents the:  
a) minimum current gain  
b) intermediate current gain  
c) **maximum current gain**  
d) cutoff point
43. A transistor has a Beta of 250 and a base current,  $I_B$ , of 20 MicroA. The collector current,  $I_C$ , equals:  
a) 500 Micro A  
b) **5 mA**  
c) 50 mA  
d) 5 A
44. A current ratio of  $I_C/I_E$  is usually less than one and is called:  
a) Beta  
b) Theta  
c) **Alpha**  
d) Omega
45. With the positive probe on an NPN base, an ohmmeter reading between the other transistor terminals should be:  
a) Open  
b) Infinite  
c) **low resistance**  
d) high resistance
46. In a C-E configuration, an emitter resistor is used for:  
a) **Stabilization**  
b) ac signal bypass  
c) collector bias  
d) higher gain
47. Voltage-divider bias provides:  
a) an unstable Q point  
b) **a stable Q point**  
c) a Q point that easily varies with changes in the transistor's current gain  
d) a Q point that is stable and easily varies with changes in the transistor's current gain
48. To operate properly, a transistor's base-emitter junction must be forward biased with reverse bias applied to which junction?  
a) collector-emitter  
b) base-collector  
c) base-emitter  
d) **collector-base**





49. The ends of a load line drawn on a family of curves determine:
- a) **saturation and cutoff**
  - b) the operating point
  - c) the power curve
  - d) the amplification factor
50. If  $V_{CC}=+18V$ , voltage divider resistor  $R_1$  is  $4.7K\Omega$ , and  $R_2$  is  $1500\ \Omega$ , what is the base bias voltage?
- a)  $8.70\ V$
  - b)  **$4.35\ V$**
  - c)  $2.90\ V$
  - d)  $0.7\ V$
51. The C-B configuration is used to provide which type of gain?
- a) **voltage**
  - b) current
  - c) resistance
  - d) power
52. The Q point on a load line may be used to determine:
- a)  $V_C$
  - b)  $V_{CC}$
  - c)  **$V_B$**
  - d)  $I_C$
53. A transistor may be used as a switching device or as a:
- a) fixed resistor
  - b) tuning device
  - c) rectifier
  - d) **variable resistor**
54. Which is beta's current ratio?
- a)  $I_C/I_B$
  - b)  **$I_C/I_E$**
  - c)  $I_B/I_E$
  - d)  $I_E/I_B$



## 4. Field Effect Transistors

Position in Question Paper

Total Marks - 16

Q.1. b) 2-Marks.

Q.2. c) 4-Marks.

Q.3. a) 4-Marks.

Q.6. c) 6-Marks.

### Descriptive Questions

1. Draw the symbol of N-channel & P-channel of MOSFET.
2. Classify the FET
3. Explain with a neat circuit diagram the operation of N-channel JFET.
4. Explain operation of P-channel JFET with neat circuit diagram.
5. A JFET has a drain current of 5mA. If  $I_{DSS} = 10\text{mA}$  and  $V_{GS}(\text{OFF}) = -6\text{V}$ . Find the value of
  - a)  $V_{GS}$
  - b)  $V_P$
6. Determine
  - a) AC drain resistance
  - b) Transconductance
  - c) Amplification factor
7. Explain working principle of N-Channel depletion type MOSFET with construction diagram.
8. Compare depletion type MOSFET & enhancement type MOSFET.
9. Draw the construction of MOSFET and explain the working.
10. Draw the drain characteristics and transfer characteristic of JFET.



## MCQ Question

(Total number of Question=Marks\*3=11\*3=33)

Note: Correct answer is marked with **bold**.

- \_\_\_\_\_of the following statement is true about FET?
  - It has high output impedance
  - it has high input impedance**
  - it has low input impedance
  - it does not offer any resistance
- Comparing the size of BJT and FET, choose the correct statement?
  - BJT is larger than the FET**
  - BJT is smaller than the FET
  - Both are of same size
  - Depends on application
- What is the main advantage of FET which makes it more useful in industrial applications?
  - Voltage controlled operation
  - Less cost
  - Small size**
  - Semiconductor device
- For a FET when will maximum current flows?
  - $V_{gs} = 0V$
  - $V_{gs} = 0V$  and  $V_{ds} \geq |V_p|$**
  - $V_{DS} \geq |V_p|$
  - $V_p = 0$
- To use FET as a voltage controlled resistor, in which region it should operate?
  - Ohmic region**
  - Cut off
  - Saturation
  - Cut off and saturation
- For an n-channel FET, What is the direction of current flow?
  - Source to drain
  - Drain to source**
  - Gate to source
  - Gate to drain
- For a p-channel FET, What is the direction of current flow?
  - Source to drain**
  - Drain to source
  - Gate to source
  - Gate to drain
- Which of the following can be considered to be an advantage of FET amplifier as compared to BJT amplifier?
  - Higher input impedance
  - Good bias stability
  - Higher gain-bandwidth product
  - Lower noise figureSelect the correct answer using the codes given below Codes:
  - A, B and C
  - A, B and D**
  - B, C and D
  - A, C and D
- The pinch off voltage of JFET is 5v. What is its cut off voltage?





- c) 3mS  
d) **3.5mS**
18. A FET has  $I_{DSS}=4I_D$  and  $g_{m0} = 10\text{mS}$  then  $g_m =$  \_\_\_\_\_.
- a) 10mS  
c) **5mS**
- b) 20mS  
d) 14mS
19. Determine the value of output impedance for JFET, if the value of  $g_m = 1\text{mS}$ ?
- a) **1 Kohm**  
c) 100Kohm
- b) 0 ohm  
d) 5 Kohm
20. In a small signal equivalent model of an FET, What does  $g_m V_{GS}$  stand for?
- a) A pure resistor  
c) Current controlled current source
- b) **Voltage controlled current source**  
d) Voltage controlled voltage source
21. The threshold voltage of an n-channel MOSFET can be controlled by which of the following parameter?
- a) Increasing the channel dopant concentration
- b) **Reducing the channel dopant concentration**
- c) Reducing the gate-oxide thickness
- d) Reducing the channel
22. MOSFET can be used as \_\_\_\_\_.
- a) **Voltage controlled capacitor**  
c) Voltage controlled inductor
- b) Current controlled capacitor  
d) Current controlled inductor
23. The effective channel length of a MOSFET in saturation decreases with increase in which of the following parameter?
- a) Gate voltage  
c) Source voltage
- b) **Drain voltage**  
d) Body voltage
24. In a MOSFET operating in a saturation region, the channel length modulation effect causes
- a) An increase in gate-source capacitance
- b) Decrease in Trans conductance
- c) Decrease in the unity gain cut off
- d) **Decrease in the output impedance**
25. Which of the following effects can be caused by decrease in temperature?
- a) Increase in MOSFET current  
c) **Decrease in MOSFET current**
- b) Increase in BJT current  
d) Decrease in BJT current
26. Which of the following statement is true about enhancement MOSFET?
- a) It acts as closed switch
- b) **It acts as open switch**
- c) It acts as resistor with small resistance
- d) Capacitor



27. For a transistor in its circuit symbol, the line between drain and source was broken, what does this indicate?
- a) BJT
  - b) JFET
  - c) Depletion type MOSFET
  - d) **Enhancement type MOSFET**
27. For a fixed bias circuit the drain current was 1mA, what is the value of source current?
- a) 0mA
  - b) 1mA
  - c) **2mA**
  - d) 3mA
28. For a fixed bias circuit the drain current was 1mA,  $V_{DD}=12V$ , determine drain resistance required if  $V_{DS}=10V$ ?
- a) 1K $\Omega$
  - b) 1.5K $\Omega$
  - c) **2K $\Omega$**
  - d) 4K $\Omega$
29. The MOSFET trans conductance parameter is the product of \_\_\_\_\_.
- a) Process trans conductance and inverse of aspect ratio
  - b) Inverse of Process trans conductance and aspect ratio
  - c) Inverse of Process trans conductance and inverse of aspect ratio
  - d) **Process trans conductance and aspect ratio**
30. For a p channel MOSFET which of the following is not true?
- a) The source and drain are a p type semiconductor
  - b) **The induced channel is p type region which is induced by applying a positive potential to the gate**
  - c) The substrate is a n type semiconductor
  - d) None of the mentioned
31. The saturation current of the MOSFET is the value of the current when \_\_\_\_\_.
- a) **The voltage between the drain and drain becomes equal to the overdrive voltage**
  - b) The voltage between the drain and drain becomes equal to the threshold voltage
  - c) The voltage between the drain and drain becomes equal to the voltage applied to the gate
  - d) The voltage between the drain and drain becomes equal to difference the overdrive voltage and the threshold voltage
32. Ideal maximum voltage for common drain amplifier is \_\_\_\_\_.
- a) 0
  - b) **1**
  - c) 0.5
  - d) 2
33. The pinch off voltage of JFET is 5v. What is its cut off voltage?
- a) 2.5V
  - b) 3V
  - c) 4V
  - d) **5V**



## 5 Sensors and Transducers

Position in Question Paper

Total Marks - 24

Q.1. d) 2-Marks.

Q.1. f) 2-Marks.

Q.3. c) 4-Marks.

Q.4. d) 4-Marks.

Q.5. a) 6-Marks.

Q.6. a) 6-Marks

### Descriptive Questions

1. Draw constructional diagram of piezoelectric transducer.
2. State the function of proximity sensors and photodiode
3. Define transducer and name two passive transducers.
4. State Seebeck and Peltier effect.
5. Define transducers and name two active transducers.
6. Draw symbol of photodiode.
7. State any four selection criteria for transducers
8. Explain:
  - a) Seebeck effect
  - b) Peltier effect
9. Identify active and passive transducer from the following transducers:
  - a) Capacitive transducer
  - b) Photovoltaic cells
  - c) Piezoelectric transducer
  - d) Strain gauge
  - e) Thermocouple
  - f) Thermistors
10. Differentiate active and passive transducer on the basis of any four points.
11. Explain any four selection criteria of transducers for temperature measurement.
12. List four types of electrical pressure transducer and describe one application of each one.
13. List four types of electrical pressure transducers and describe one application of each one.
14. Explain the working principle of photo transistor and photodiode with neat sketches.



## MCQ Question

(Total number of Question=Marks\*3=13\*3=39)

Note: Correct answer is marked with **bold**.

- How many types of transducers are there?  
a) **2** c) 6  
b) 4 d) 8
- Mechanical transducers sense \_\_\_\_\_  
a) Electrical changes c) chemical changes  
b) **physical changes** d) biological change
- Mechanical transducers generate \_\_\_\_\_  
a) Electrical signals c) **physical signals**  
b) chemical signals d) biological signals
- Electrical transducers generate \_\_\_\_\_  
a) Biological signals c) physical signals  
b) chemical signals **d) electrical signals**
- The power needs of electrical transducers is \_\_\_\_\_  
a) Maximum c) Zero  
b) **Minimum** d) infinite
- Electrical transducers are \_\_\_\_\_  
a) Small and non-portable c) **small and compact**  
b) large and non-portable d) large and portable
- Mechanical transducers cause \_\_\_\_\_  
a) Power loss c) eddy current loss  
b) hysteresis loss **d) frictional loss**
- Active transducers are classified into \_\_\_\_\_  
a) **4 types** c) 6 types  
b) 2 types d) 8 types
- Active transducers develops \_\_\_\_\_  
a) Mechanical parameter c) chemical parameter  
b) **electrical parameter** d) physical parameter
- How do passive transducers develop electrical signals?  
a) Using a transformer c) **using external source**  
b) using internal source d) using a diode
- In electromagnetic based transduction measured is \_\_\_\_\_  
a) converted into mechanical force  
b) **converted into electromotive force**  
c) converted into chemical force





- d) converted into physical force
12. Analog transducers convert input into \_\_\_\_\_
- a) Voltage c) Digital  
b) Current d) **analog**
13. The output of a transducer must \_\_\_\_\_
- a) be different at different environment conditions  
b) **be same at all environment conditions**  
c) be same at some environment conditions  
d) be zero always
14. The output of a transducer must be \_\_\_\_\_
- a) Low c) **High**  
b) Medium d) zero
15. The size of a transducer must be \_\_\_\_\_
- a) Infinite c) Large  
b) Zero d) **small**
16. A transducer must be \_\_\_\_\_
- a) **Quick in response** c) medium in response  
b) slow in response d) very slow in response
17. The output of a transducer must \_\_\_\_\_
- a) Be less reliable c) not be reliable  
b) **be highly reliable** d) be of medium reliability
18. The range of a transducer is \_\_\_\_\_
- a) Medium c) **Large**  
b) Narrow d) zero
19. The transducer output is \_\_\_\_\_
- a) Exponential c) non-linear  
b) unit step d) **linear**
20. Which of the following is correct for tactile sensors?
- a) **Touch sensitive** c) Input voltage sensitive  
b) Pressure sensitive d) Humidity sensitive
21. Change in output of sensor with change in input is \_\_\_\_\_
- a) Threshold c) **Sensitivity**  
b) Slew rate d) none of the mentioned
22. Sensitivity of a sensor can be depicted by \_\_\_\_\_
- a) Niquist plot c) **Bode plot**  
b) Pole- zero plot d) none of the mentioned
23. Smallest change which a sensor can detect is \_\_\_\_\_



- a) **Resolution** c) Precision  
b) Accuracy d) Scale
24. Which of the following is not an analog sensor?  
a) Potentiometer c) Accelerometers  
b) Force-sensing resistors d) **None of the mentioned**
25. Semiconductor used in sensors will be \_\_\_\_\_  
a) Pure form c) **Pure or doped form**  
b) Doped form d) none of the mentioned
26. Which of the following represent active transducer?  
a) Strain gauge c) LVDT  
b) Thermistor d) **Thermocouple**
27. Which transducer is known as 'self-generating transducer'?  
a) **Active transducer** c) Secondary transducer  
b) Passive transducer d) Analog transducer
28. What is the relation between scale factor and sensitivity of a transducer?  
a) Scale factor is double of sensitivity  
b) **Scale factor is inverse of sensitivity**  
c) Sensitivity is inverse of scale factor  
d) Sensitivity is equal to scale factor
29. Which of the following is an analog transducer?  
a) Encoders c) Digital tachometers  
b) **Strain gauge** d) Limit switch
30. What is the principle of operation of LVDT?  
a) **Mutual inductance** c) Permanence  
b) Self-inductance d) Reluctance
31. Which of the following can be measured using Piezo-electric transducer?  
a) Velocity c) **Force**  
b) Displacement d) Sound
32. Capacitive transducer is used for?  
a) Static measurement c) Transient measurement  
b) **Dynamic measurement** d) both static and dynamic
33. Which of the following is used in photo conductive cell?  
a) **Selenium** c) Rochelle salt  
b) Quartz d) Lithium sulphate
34. Which type of material can be sensed by inductive proximity sensor?  
a) Wooden type c) Plastic type  
b) **Metallic type** d) Glass type



Maratha Vidya Prasarak Samaj's

**Rajarshi Shahu Maharaj Polytechnic, Nashik**

Udoji Maratha Boarding Campus, Near Pumping Station, Gangapur Road, Nashik-13.

Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai.

35. Which metal will have a larger range of detection by inductive proximity sensor?
- a) **Iron**
  - b) Aluminum
  - c) Copper
  - d) **Lead**
36. Which metal will have a larger range of detection by inductive proximity sensor?
- a) Zinc
  - b) **Steel**
  - c) Copper
  - d) **Lead**
37. Which is an example of infrared proximity sensor?
- a) **GP2Y0A41SK0F**
  - b) MCP793V-500
  - c) SLB700A/06VA
  - d) BMP180
38. Which type of proximity sensor can be used as touch sensor?
- a) **Inductive proximity sensor**
  - b) Capacitive proximity sensor
  - c) Ultrasonic proximity sensor
  - d) **photoelectric proximity sensor**
39. Which type of proximity sensor can detect a magnetic substance even if a wall of non-ferrous substance is made?
- a) **Magnetic proximity sensor**
  - b) capacitive proximity sensor
  - c) Ultrasonic proximity sensor
  - d) photoelectric proximity sensor