Subject: - Basic Electronics (22225)



#### Rajarshi Shahu Maharaj Polytechnic, Nashik

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## SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Electronic components and Signals	10
2	Diode and their Applications	22
3	Bipolar Junction Transistor	24
4	Filed Effect Transistors	16
5	Sensors and Transducers	24
	Total Marks:-	96

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## **BOARD THEORY** PAPER PATTERN **FOR BEC (22225)**

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



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	d)	Sensors and Transducers
	e)	Bipolar Junction Transistor.
Q.5		Attempt any TWO 2*6=12
	a)	Sensors and Transducers
	<b>b</b> )	Diode and their Applications
	c)	Bipolar Junction Transistor
Q.6		Attempt any TWO 2*6=12
	a)	Sensors and Transducers
	<b>b</b> )	Bipolar Junction Transistor
	c)	Filed Effect Transistors



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#### 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>b</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>b</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



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### CLASS TEST - II PAPER PATTERN

**Syllabus:-**

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	s Course Outcome
		(CO)
a)	Sensors and Transducers	CO225.5
<b>b</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	s
a)	Filed Effect Transistors	CO225.4
<b>b</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



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### **COURSE OUTCOME** (CO)

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

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

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# 1. Electronic components and Signals

_	9
Position in Question Paper Q.1. a) 2-Marks. Q.1. e) 2-Marks. Q.2. a) 4-Marks. Q.3. b) 4-Marks. Q.4. d) 4-Marks. Q.6. b) 6-Marks.	Total Marks - 12
<b>Descriptive Questions</b>	
1. Draw the symbol of Inductor and	Capacitor
2. Define active components and pa	ssive components
3. List any four specifications of res	sistors
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 disa	
7. Give four differences between an	
•	circuits over circuits with discrete components.
9. Determine the value of resistance	e with following colour code:
i.Red, Red, Orange, Gold	
ii.Brown, Black, Black, Silver	as with the following colour and
<ul><li>10. Determine the value of capacitan</li><li>i.Orange, Orange, Blue</li></ul>	ce with the following colour code.
ii.Yellow, Violet, Yellow	
MCQ Question	¥2 12¥2 26\
(Total number of Question=Mark	·
Note: Correct answer is marked with	
<ol> <li>Out of following which is not a ty</li> <li>a) Resistor</li> </ol>	c) FET
b) Capacitor	d) Inductor
•	nge in flow of current is known as
a) Capacitance	c) Conductance
b) Resistance	d) Inductance

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- 3. Calculate the value of resistance of following color code resistance: RED RED ORANGE GOLD
  - a) 1.2 K Ohm

c) 97 K Ohm

b) 470 Ohm

- d) 22 K Ohm
- 4. Out of following is not a type of capacitor:
  - a) Ceramic Capacitor

c) Wire wound

b) Mica Capacitor

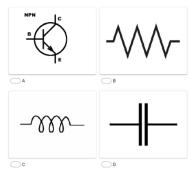
- d) Electrolytic Capacitor
- 5. Out of following which is not a advantage of Integrated circuit:
  - a) Small size and weight

c) High speed

b) High reliability

d) High initial cost

6. Identify the symbol of Inductor:



- 7. The number of cycle of waveform per second is defined as \_\_\_\_\_.
  - a) Frequency

c) Amplitude

b) Time period

- d) Wavelength
- 8. An active device is one which \_\_\_\_\_
  - a) Mechanically controls electron flow
  - b) Electrically controls electron flow
  - c) Pneumatically controls electron flow
  - d) Automatically controls electron flow
- 9. Which of the following elements comprise of the passive devices?
  - a) Resistors, Capacitors and SCRs
  - b) Vacuum Tubes, SCRs and Diodes
  - c) Transformers, Inductors and Diodes
  - d) Transformers, TRIACs and DIACs
- 10. A transistor is a current controlled device because\_\_\_\_\_
  - a) In the base region movement of charge carrier is because of the electrons which are minority charge carrier in the base region
  - b) In the collector region movement of charge carrier is because of the electrons which are minority charge carrier in the collector region
  - c) In the base region movement of charge carrier is because of the holes which are majority charge carrier in the base region

d) In the collector region movement of	charge carrier is because	e of the holes which
are majority charge carrier in the base	region	
11. Active devices can also be used as		
a) Amplifiers	c) Converters	
b) Choppers	d) Inverters	
12. How do amplifiers work without viola	ating Law of Conservation	on of Energy?
a) They amplify one factor of the input	t and reduce others	
b) They work on the law of conservation	on of mass	
c) They violate the Law of Conservation	on of Energy	
d) They amplify the signal by taking	— -	rnal source
13. The symbol used for capacitance is		
a)	c) (1000	
a)	,	
1. /	c) ————————————————————————————————————	
<b>b)</b> —		
<b>b</b> )	d)	
14. The formula used to find the capacitar		
a) Q/v	c) Q-v	
b) Qv	d) Q + v	
15. The capacitor doesn't allow sudden ch	nanges in	
a) Voltage	c) Resistance	
b) Current	d) Capacitance	
16. The Inductor doesn't allow sudden cha	anges in	
a) Voltage	c) Resistance	
b) Current	d) Inductance	
17. The expression for energy of an induc		
a) ½ LI	c) $\frac{1}{2}$ L <sup>2</sup> I	
b) L/2I	d) ½ LI	
18. The units for inductance is	_ and capacitance is	
a) Faraday, Henry	c) Henry, Fara	day
b) Coulomb, Faraday	d) Henry, Could	omb
19. If a capacitor of capacitance 9.2F ha	as a voltage of 22.5V ac	cross it. Calculate the
energy of the capacitor.		
a) 5062.5W	c) 50.625W	
b) 506.25W	d) 50625W	
20. If the voltage across a capacitor is	constant, then current	passing through it is
a) 1	c) -1	
b) 0	d) Infinity	
21. Inductor works as a circ	cuit for DC supply.	
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 $\overline{ ext{RSM POLY}}$  Affiliated to MSBTE Mumbai, Approved by AICTE New Delhi, DTE Mumbai & Govt. of Maharashtra, Mumbai. c) Polar a) Open b) Short d) Non-polar 22. The insulating medium between the two plates of capacitor is known as \_\_\_\_\_ a) Electrode c) Conducting medium b) Capacitive medium d) Dielectric 23. Two capacitors, each of 220 µF, are connected in parallel. The capacitance of the combination will be: a) 110µF c) 440µF b) 220µF 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 c) variable resistor d) temperature resistor b) preset resistor 26. Two capacitors, each of 15 µF, are connected in series. The capacitance of the combination will be: a)  $7.5 \mu F$ c) 30µF d) 4.5mF b) 15μF 27. The fourth band of a four band resistor is marked in silver. This indicates a tolerance of: a) 5% c) 20% d) 40% b) 10% 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 c) 2 A b) 20 A d) 5mA 29. The third band of a four band resistor is marked in black. This indicates a

b) 10

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multiplier of:

a) 1

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c) 10	00	d) 1000
,	inductors, each of 6.8 mH, are connected	,
	oination will be:	o an possession and another or one
	4 mH	c) mH
*	8 mH	d) 34mH
•	oss-free transformer has 1200 primary to	,
	ary winding is connected to a 200 V AC	
-	the secondary voltage:	supply which one of the following
a) <b>50</b>	· ·	c) 800 V
b) 90		d) 15 V
,	00 nF capacitor has a tolerance of ±5%.	,
	ponent will be:	Possion Publication
a) 95		c) 110 nF
b) 10		d) 58nF
•	resistance of a light dependent resistor:	.,
	lls with increasing light level	
	creases with increasing light level	
	mains constant irrespective of light level	
	creases with decreasing light level	
	resistors, each of 15 $\Omega$ , are connected in	series. The resistance of the
comb	oination will be:	
a) 7.	$5\Omega$	c) 30Ω
b) 59	Ω	d) 8Ω
35. A gra	aph of charge, Q, plotted against voltage,	, V, for a capacitor will take the form
of:		
a) a c	curve that rises rapidly	c) a straight line.
b) a (	curve that falls rapidly	d) a exponential line
36. The	third band of a four band resistor is marke	ted in orange. This indicates a
multi	plier of:	
a) 1,	000	c) 100,000

d) 150,000

b) 10,000

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#### 2. Diode and their Applications

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#### **Position in Question Paper**

**Total Marks - 16** 

Q.1. b) 2-Marks.

Q.1. c) 2-Marks.

Q.2. d) 4-Marks.

Q.3. a) 4-Marks.

**Q.4.** a) 4-Marks.

Q.6. a) 6-Marks.

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#### **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 principal 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=4	<b>(8</b> )
--	-------------

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

1. The forward voltage drop across a silicon diode is about \_\_\_\_\_\_

a) 2.5 V

c) 10 V

b) 3 V

d) 0.7 V

# TECHNICAL STATES

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2. A transistor has PN juncti	ons.
a) One	c) Three
b) Two	d) Four
3. Main use of Zener diode is in which b	piasing mode?
a) Forward Biasing	c) Both
b) Reverse Biasing	d) None of the above
4. Total number of diodes used in Bridg	e full wave rectifier is
a) 1	c) 3
b) 2	d) 4
5. Out of following which material is no	t used in combination of manufacturing LEDs.
a) Gallium	c) Phosphate
b) Arsenide	d) Germanium
6. Out of following, Which one isn't a ty	ype of rectifier?
a) Precision Half-wave Rectifier	c) Peak Rectifier
b) Bridge Rectifier	d) Centre tapped Rectifier
7. In a full wave rectifier, if the input f	requency is 50 Hz, then output frequency will
be	
a) 50 Hz	c) 100 Hz
b) 75 Hz	d) 200 Hz
8 is not a type of filter co	mponent in regulated power supply circuit.
a) Shunt C Filter	c) LC Filter
b) Series L Filter	d) Transistor
9. Except transformer, the main parts of	regulated power supply are
a) Filter and Regulator	c) Transistor and Regulator
b) Filter and transistor	d) Rectifier, Filter and Transistor
10. The AC components are filtered	most to produce pure DC by which of the
following filter?	
a) C-L-C Filter	c) Series Inductor
b) Shunt Capacitor	d) L-C Filter
11. In P-N-P transistor, base will be of _	material.
a) P material	c) Either of the above
b) N material	d) None of the above
12. The base current amplification factor	rβis given by
a) IB/IC	c) IB/IE
b) IE/IB	d) IC/IB
13. The relation between $\alpha$ and $\beta$ is	·

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a) $\beta = \alpha/(1-\alpha)$	c) $\beta = \alpha/(1+\alpha)$
b) $\alpha = \beta/(1+\beta)$	d) $\alpha = \beta/(1-\beta)$
Consider a peak rectifier fed l	by a 60-Hz sinusoid having a pea
T 1 1 1 1	10 01 1 1 1 0 1 01

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 $Vp = 100 \text{ V}$ .		
-	alate the fraction of the cycle during which		
the diode is conducting	, c		
a) 1.06 %	c) 3.18%		
b) 2.12 %	d) 4.24%		
15. Ageing of a selenium rectifier may chan	ge 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 p	orimarily 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	•		
V <sub>m</sub> sinωt and the load resistance is RL. The	E		
a) $V_{\rm m}/\sqrt{2R_{\rm L}}$	c) $2V_{\rm m}/\sqrt{\pi}$		
b) $V_m/(R_F+R_L)\pi$	d) $V_m/R_L$		
18. In a half wave rectifier, the sine wave i	nput is 50sin50t. If the load resistance is of		
1K, then average DC power output will b	pe?		
a) 3.99V	c) 5.97V		
b) 2.5V	d) 6.77V		
19. In a half wave rectifier, the sine wave	input is 200sin300t. The average value of		
output voltage is?	\ (0.47)		
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% 21 If peak voltage for a half wave rectifier.	d) 46%		
21. If peak voltage for a half wave rectifier of 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 w	•		
a) 0.234	c) 0.287		
b) 0.279	d) 0.453		
00 TC 1 ' C C 1 1C	.'C' ' 100II .1 .1 .1 .C		

23. If the input frequency of a half wave rectifier is 100Hz, then the ripple frequency

will be .

a) 150Hz c) 100Hz d) 300Hz b) 200Hz

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24. Ripple factor of a half wave re	ectifier is I <sub>m</sub> is the peak current and RL is
load resista	nce
a) 1.414	c) 1.4
b) 1.21	d) 0.48
25. Efficiency of a centre tapped	full wave rectifier is
a) 50%	c) 70%
b) 46%	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	e is neglected, what is the ripple voltage?
a) 0.562V	c) 0.954V
b) 0.785V	d) 0.344V
	50W to a load of $200\Omega$ . If the ripple factor is 2%,
calculate the AC ripple across	c) 4V
<b>a) 2V</b> b) 5V	d) 1V
,	I resistor of 1500Ω. Assume the diodes have $R_f=10\Omega$ ,
	diode is 30V with a frequency of 50Hz. Calculate the
AC power input.	flode is 50 v with a frequency of 50ffz. Calculate the
a) 368.98mW	c) 145.76mW
b) 275.2mW	d) 456.78mW
•	a full wave rectifier, the ripple frequency of it would
be	a ran wave recimer, the ripple frequency of it would
a) 100Hz	c) 25Hz
b) 50Hz	d) 500Hz
,	of a centre tapped full wave rectifier is
a) 0.623	c) 0.693
b) 0.678	d) 0.625
·	tapped full wave rectifier circuit is 5V and diode cut
in voltage is 0.7. The peak inve	
a) 4.3V	c) 5.7V
<b>b</b> ) 9.3V	d) 10.7V
32. In a centre tapped full wave re	ectifier, the input sine wave is 250sin100t. The output
ripple frequency will be	
a) 50Hz	c) 25Hz
b) 100Hz	d) 200Hz
33. DC average current of a bridg	ge full wave rectifier (where I <sub>m</sub> is the maximum peak
current of input).	
a) $2I_m$	c) $I_m/2$
b) I <sub>m</sub>	d) 1.414I <sub>m</sub>
34. Ripple factor of bridge full wa	we rectifier is?

#### बहुजन दिला। बहुजन दिला।

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a) 1.414	c) 0.482
b) 1.212	d) 1.321
35. If input frequency is 50Hz then ripple freq	uency of bridge full wave rectifier will
be equal to	) 45H
a) 200Hz	c) 45Hz
b) 50Hz	d) <b>100Hz</b>
36. Transformer utilization factor of bridge full	
a) 0.623	c) 0.693
b) <b>0.812</b>	d) 0.825
37. That eliminates fluctuation in a rectified vo	-
DC voltage, a component called	
a) Filter	c) Modulator
b) Rectifier	d) Amplifier
38. When a 10 V peak input voltage is applied	
limiter of 5 v, then the bias voltage is	
a) 0.7 V	c) 4.3 V
b) 3.4 V	d) 3 V
39. Linear regulation devices that have	
a) Two terminals	c) One terminal
b) Three terminals	d) Four terminal
40. If the peak voltage applied as input is 100v,	
a) 100V	c) 9V
b) 90V	d) 99.3V
41 device is used to couple AC	-
a) Rectifier	c) Amplifier
b) Modulator	d) <b>Transformer</b>
42. Which circuit activity may shift a characte	ristic curve so that the diode operating
point is different	
a) Lower current	c) <b>High power(heat)</b>
b) High resistance	d) Lower voltage
43. A crystal diode consists of	
a) One PN Junction	c) Four PN Junction
b) Two PN Junction	d) Three PN Junction
44. The order of reverse current in a diode is	
a) A	c) mA
b) <b>μA</b>	d) KA
45. When full-wave rectified voltage with a pea	k value of 60v then average value equal

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to	
a) 12.45V	c) 32.14V
b) <b>38.12V</b>	d) 23V
46. When a diode is forward bia	sed, the voltage across it
a) is directly proportional to	the current
b) is inversely proportional t	to the current
c) is directly proportional to	the source voltage
d) remains approximately th	e same
47. A silicon diode in a half-wa	ve rectifier has a barrier potential of 0.7 V. This has the
effect of	
a) reducing the peak output	voltage by 0.7 V.
b) increasing the peak outpu	t voltage by 0.7 V.
c) reducing the peak input	voltage by 0.7 V.
d) no effect.	
48. PIV is which of the following	ıg?
a) peak input voltage	c) peak immediate voltage
b) peak inverse voltage	d) positive input voltage

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#### 3. Bipolar Junction Transistor

Position in Question Paper

Q.1. d) 2-Marks.
Q.1. e) 2-Marks.
Q.2. d) 4-Marks.
Q.2. e) 4-Marks.
Q.3. c) 4-Marks.
Q.4. d) 4-Marks.
Q.5. a) 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.** 

1	. ]	n	transi	former	coupled	amplifier,	coupling	takes p	place using	<u> </u>

a) Capacitor

c) Transformer

b) Single Wire

- d) RC Network
- 2. The colour code for 680 uH inductor with +- 5% tolerance is:

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a) Plus Grov Proven Cold	c) Orange Grey Brown Gold
a) Blue Grey Brown Gold	•
b) Black Grey Brown Gold	d) Red Grey Brown Gold
3. The typical value of the current gain	of a common-base configuration
is	
a) Less than 1	c) Between 100 and 200
b) Between 1 and 50	d) Undefined
4. The doping concentration of which terminal of	BJT transistor is highest?
a) Base	c) Collector
b) Emitter	d) Same for all terminals
5. The current gain of common base configuration	n is denoted by
a) Beta	c) Alpha
b) Gama	d) Zeta
6. Which of the following is not a part of a BJT?	3, _0
a) Base	c) Emitter
b) Collector	d) None of the mentioned
7. The number of pn junctions in a BJT is/are	,
a) 1	c) 3
b) 2	d) 4
8. In which of the following modes can a BJT be	
a) Cut-off mode	c) Saturation mode
b) Active mode	d) All of the mentioned
9. If a BJT is to be used as an amplifier, then it m	
a) Cut-off mode	c) Saturation mode
<ul><li>b) Active mode</li><li>10. If a BJT is to be used as a switch, it must oper</li></ul>	d) All of the mentioned
a) Cut-off mode or active mode	atc III
b) Active Mode or saturation mode	
c) Cut-off mode or saturation mode	
d) Cut-off mode or saturation mode or active r	node
11. On which of the following does the scale curre	ent not depends upon?
a) Effective width of the base	
b) Charge of an electron	
c) Electron diffusivity	
d) Volume of the base-emitter junction	
12. On which of the following does the collector of	current not depends upon?
a) Saturation current	
b) Thermal voltage	iittan
<ul><li>c) Voltage difference between the base and em</li><li>d) None of the mentioned</li></ul>	iiilei
a) None of the mentioned	

13. The range for the transistor parameter also referred as common-emitter current gain Prepared By: Prof. N. A. Gade (Department of E&TC Engineering)

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has a value of	for common devi	ces.
a) 50-200		c) 750-1000
b) 400-600		d) > 1000
14. The curve between	een the collector current	versus the potential difference between the
base and emitter is		
a) A straight line	inclined to the axes	c) An exponentially varying curve
b) A straight line	parallel to the x-	d) A parabolic curve
axis		
15. The curve between	een the collector current	and the saturation is
a) A straight lin	e inclined to the axes	
b) A straight line	e parallel to the x-axis	
c) A straight line	parallel to the y-axis	
d) An exponentia	al curve	
16. The correct relat	tion between the transisto	or parameters α and β are related by
a) $\beta = 1 - \alpha/\alpha$		c) $\alpha = \beta + 1/\beta$
b) $\beta = 1 + \alpha/\alpha$		$\mathbf{d}) \ \alpha = \beta/\beta + 1$
17. The correct expr	ession relating the emitt	er current Ie to the collector current Ic is
a) $Ie = \alpha Ic$		c) $Ie = \beta Ic$
b) $Ic = \alpha Ic$		d) $Ic = \beta Ic$
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 rela	tion between the emitter	current Ie and the base current Ib is given
by		
a) $Ib = (1 + \alpha) Ie$		c) Ie = $(1 - \beta)$ Ib
b) Ib = $(\alpha - 1)$ Ie		$\mathbf{d)} \mathbf{Ie} = (1 + \mathbf{\beta}) \mathbf{Ib}$
20. The Early Effect	t is also called as	
a) Base-width m	nodulation effect	c) Both of the mentioned
b) Base-width an	nplification effect	d) None of the mentioned
21. For the BJT to o	perate in active mode Co	ollector-Base junction must be
a) Heavily doped	1	c) Must be forward bias
b) Must reverse	d bias	d) Lightly doped
22. Which of the fol	lowing 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 curre	ent is non zero	
d) All of the men	ıtioned	
23. Which of the fol	lowing is true for the cur	t-off region in an npn transistor?
a) Potential diffe	rence between the emitte	er and the base is smaller than 0.5V
h) Potential diff	orance between the em	itter and the bace is smaller than AV

c) The collector current increases with the increase in the base current

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- 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
  - 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  $0.2\mathrm{V}$
  - 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  $0.5\mathrm{V}$
- 28. The potential difference between the base and the collector Vcb in a pnp transistor in saturation region is \_\_\_\_\_

a) -0.2 V b) -0.5 V c) 0.2 V d) 0.5 V

29. For a pnp transistor in the active region the value of Vce (potential difference between the collector and the base) is

a) Less than 0.3V

c) Greater than 0.3V

b) Less than 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?

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- 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

c) 1.67 mV

b) 1.47 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 Vcb in a pnp transistor in saturation region is \_\_\_\_\_

a) -0.2 V

c) 0.2 V

**b)** -0.5V

d) 0.5 V

- 36. A pnp transistor in the active region the value of Vce (potential difference between the collector and the base) is
  - a) Less than 0.3V

c) Greater than 0.3V

b) Less than 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	c) <b>3</b>
b) 2	d) 4
40. One of important application of transisto	or is
a) Amplification	c) Voltage regulator
b) Emits light	d) Line regulator
41. When transistors are used in digital circu	uits they usually operate in the:
a) active region	c) saturation and cutoff regions
b) breakdown region	d) linear region
42. Three different Q points are shown on a	a dc load line. The upper Q point represents
the:	
a) minimum current gain	c) maximum current gain
b) intermediate current gain	d) cutoff point
43. A transistor has a Beta of 250 and a ba	se current, IB, of 20 MicroA. The collector
current, IC, equals:	
a) 500 Micro A	c) 50 mA
b) 5 mA	d) 5 A
44. A current ratio of I <sub>C</sub> /I <sub>E</sub> is usually less that	an one and is called:
a) Beta	c) Alpha
b) Theta	d) Omega
45. With the positive probe on an NPN bas	se, an ohmmeter reading between the other
transistor terminals should be:	
a) Open	c) low resistance
b) Infinite	d) high resistance
46. In a C-E configuration, an emitter resiste	or is used for:
a) Stabilization	c) collector bias
b) ac signal bypass	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 chang	ges in the transistor's current gain
d) a Q point that is stable and easily vari	ies with changes in the transistor's current
gain	
48. To operate properly, a transistor's base	e-emitter junction must be forward biased
with reverse bias applied to which junction?	
a) collector-emitter	c) base-emitter
b) base-collector	d) collector-base

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49. The ends of a load line drawn on a family of curves determine:

a) saturation and cutoff	c) the power curve
b) the operating point	d) the amplification factor
50. If Vcc=+18V, voltage devider re	esistor R1 is 4.7Kohm, and R2 is1500 ohm, what is
the base bias voltage?	
a) 8.70 V	c) 2.90 V
b) <b>4.35 V</b>	d) 0.7 V
51. The C-B configuration is used to	provide which type of gain?
a) voltage	c) resistance
b) current	d) power
52. The Q point on a load line may b	be used to determine:
a) V <sub>C</sub>	c) $V_B$
b) V <sub>CC</sub>	d) $I_C$
53. A transistor may be used as a sw	itching device or as a:
a) fixed resistor	c) rectifier
b) tuning device	d) variable resistor
54. Which is beta's current ratio?	
a) $I_C/I_B$	c) $I_B/I_E$
b) $I_{\rm C}/I_{\rm E}$	d) $I_E/I_B$

#### 4. Field Effect Transistors

Position in Question Paper Q.1. b) 2-Marks. Q.2. c) 4-Marks. Q.3. a) 4-Marks. Q.6. c) 6-Marks.		Fotal Marks - 11
<b>Descriptive Questions</b>		
1. Draw the symbol of N-channel & P-cha	nnel of MOSFET.	
2. Classify the FET		
3. Explain with a neat circuit diagram the o	operation of N-channel JFE	Γ.
4. Explain operation of P-channel JFET wi	th neat circuit diagram.	
5. A JFET has a drain current of 5mA. If I	DSS= 10mA and VGS (OFI	$F_0 = -6V$ . Find the
value of		
a) V <sub>GS</sub>	b) Vp	
6. Determine		
a) AC drain resistance	c) Amplification fa	ctor
b) Transconductance		
7. Explain working principle of N-Channel	el depletion type MOSFET	with construction
diagram.		
8. Compare depletion type MOSFET & en	hancement type MOSFET.	
9. Draw the construction of MOSFET and	explain the working.	
10.Draw the drain characteristics and transf	Fer characteristic of JFET.	
MCQ Question		
(Total number of Question=Marks*3=1	1*3=33)	
Note: Correct answer is marked with <b>bold</b>		
1of the following s	tatement is true	about FET?
a) It has high output impedance	c) it has low input	impedance
b) it has high input impedance	d) it does not offer	any resistance
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2.	Comparing the size of BJT and FET	,	choose the correct statement?
	a) BJT is larger than the FET	c)	Both are of same size
	b) BJT is smaller than the FET	d)	Depends on application
3.	What is the main advantage of FET which	n	nakes it more useful in industrial
	applications?		
	a) Voltage controlled operation	c)	Small size
	b) Less cost	d)	Semiconductor device
4.	For a FET when will maximum current flows?		
	a) $V_{gs} = 0V$	c)	$V_{\rm DS}>= V_{\rm p} $
	b) $V_{gs} = 0v$ and $V_{ds} >=  V_p $	d)	$V_p = 0$
5.	To use FET as a voltage controlled resistor	, i	n which region it should operate?
	a) Ohmic region	c)	Saturation
	b) Cut off	d)	Cut off and saturation
6.	For an n-channel FET, What is the direction of	cur	rent flow?
	a) Source to drain	c)	Gate to source
	b) <b>Drain to source</b>	d)	Gate to drain
7.	For a p-channel FET, What is the direction of current flow?		
	a) Source to drain	c)	Gate to source
	b) Drain to source	d)	Gate to drain
8.	Which of the following can be considered to	be	an advantage of FET amplifier as
	compared to BJT amplifier?		
	A – Higher input impedance		
	B – Good bias stability		
	C – Higher gain-bandwidth product		
	D – Lower noise figure		
	Select the correct answer using the codes given	bel	ow Codes:
	a) A, B and C	c)	B, C and D
	b) A, B and D	d)	A, C and D
9.	The pinch off voltage of JFET is 5v. What is its	cu	t off voltage?
	a) 2.5V	c)	4V
	b) 3V	d)	5V
10	.The action of JFET in its equivalent circuit	ca	n be represented as which of the

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following?	
a) Current controlled current source	source
b) Current controlled voltage source	d) Voltage controlled Voltage source
c) Voltage controlled current	
11. Which of the following is the main adva	antage of Self bias?
a) Eliminates the need of two power s	supply
b) Maximum stability	
c) Minimum stability	
d) Maximum & Minimum stability	
12. For low value of $V_{\text{DS}}$ , the JFET behaves	s like a
a) Voltage Variable Resistor	c) Amplifier
b) Constant Voltage Device	d) Switch
13. Where does the transfer curve lie for a p	o- channel FET?
a) First quadrant	c) Third quadrant
b) Second quadrant	d) Fourth quadrant
14. Which of the following is true about n-c	channel E-MOSFET?
a) Electrons are the majority charge	carries
b) Holes are the majority charge carries	S
c) Both holes and electrons are present	in same ratio
d) Neutrons are the charge carriers	
15. Which of the following is true about Mo	OSFET?
a) There is no direction between char	nnel and gate terminal
b) There exists a channel and gate short	t connection
c) Channel is not present and cannot be	created
d) They have low input impedance	
16. What will happen if a metal is used in	nstead of Silicon dioxide in the fabrication of
MOSFET?	
a) Device burns	
b) No changes in the behavior of MOS	FET
c) Input impedance increases	
d) Current cannot be generated in MOS	SFET

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a) 1mS

17. Find the value of  $g_m$  for FET with  $I_{DSS}$ =8mA,  $V_p$ =4V,  $V_{GS}$ =-0.5V?

b) 2mS

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c) 3mS	d)	3.5mS
18. A FET has $I_{DSS}$ =4 $I_D$ and $g_{m0}$ = 10mS then $g_m$ =	=	·
a) 10mS		5mS
b) 20mS	d)	14mS
19. Determine the value of output impedance	for	JFET, if the value of $g_m = 1 \text{mS}$ ?
a) <b>1 Kohm</b>		100Kohm
b) 0 ohm	d)	5 Kohm
20.In a small signal equivalent model of an FET,	Wha	at does $g_m V_{GS}$ stand for?
a) A pure resistor		Current controlled current source
b) Voltage controlled current sourc	d)	Voltage controlled voltage source
21. The threshold voltage of an n-channel MOSI	FET	can be controlled by which of the
following parameter?		
a) Increasing the channel dopant concentration	1	
b) Reducing the channel dopant concentration	ion	
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 is	in sa	aturation 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 regio	n, tł	ne 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	y de	ecrease in temperature?
a) Increase in MOSFET current	c)	<b>Decrease in MOSFET current</b>
b) Increase in BJT current	d)	Decrease in BJT current
26. Which of the following statement is true about	enh	ancement MOSFET?
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ล`	) It	acts	as	closed	switch
$\mathbf{a}$	<i>)</i> 11	acts	as	CIUSCU	SWILCII

b)	It acts as open switch	
c)	It acts as resistor with small resistance	
d)	Capacitor	
27.Fc	r a transistor in its circuit symbol, the line bet	ween drain and source was broken,
wl	nat does this indicate?	
a)	BJT c)	Depletion type MOSFET
b)	JFET d)	<b>Enhancement type MOSFET</b>
27.Fc	r a fixed bias circuit the drain current was 1mA,	what is the value of source current?
a)	0mA c)	2mA
b)	1mA d)	3mA
28.Fc	r a fixed bias circuit the drain current was	1mA, V <sub>DD</sub> =12V, determine drain
res	sistance required if V <sub>DS</sub> =10V?	
a)	1KΩ c)	2ΚΩ
b)	$1.5$ K $\Omega$ d)	$4K\Omega$
29.Th	e MOSFET trans conductance parameter is the J	product of
a)	Process trans conductance and inverse of aspec	t ratio
b)	Inverse of Process trans conductance and aspec	t ratio
c)	Inverse of Process trans conductance and inverse	se of aspect ratio
d)	Process trans conductance and aspect ratio	
30.Fc	r a p channel MOSFET which of the following i	s not true?
a)	The source and drain are a p type semiconductor	or
b)	The induced channel is p type region which i	s induced by applying a positive
c)	potential to the gateThe substrate is a n type so	emiconductor
d)	None of the mentioned	
31.Th	e saturation current of the MOSFET is the value	of the current when
a)	The voltage between the drain and drain bed	omes equal to the overdrive
	voltage	
b)	The voltage between the drain and drain become	es equal to the threshold voltage

c) The voltage between the drain and drain becomes equal to the voltage applied to

d) The voltage between the drain and drain becomes equal to difference the overdrive

voltage and the threshold voltage Prepared By: Prof. N. A. Gade (Department of E&TC Engineering)

the gate

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32. Ideal maximum voltage for comm	on drain amplifier is
a) 0	c) 0.5
b) 1	d) 2
33. The pinch off voltage of JFET is 5	v. What is its cut off voltage?
a) 2.5V	c) 4V
b) 3V	d) <b>5V</b>

#### **5 Sensors and Transducers**

#### **Position in Question Paper**

**Total Marks - 13** 

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

d) Strain gauge

b) Photovoltaic cells

e) Thermocouple

c) Piezoelectric transducer

- f) Thermisters
- 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 sand 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 principal of photo transistor and photodiode with neat sketches.



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#### **MCQ Question**

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

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

1.	How many types of transducers are there?					
	a) 2	c) 6				
	b) 4	d) 8				
2.	Mechanical transducers sense					
	a) Electrical changes	c) chemical changes				
	b) physical changes	d) biological change				
3.	Mechanical transducers generate					
	a) Electrical signals	c) physical signals				
	b) chemical signals	d) biological signals				
4.	Electrical transducers generate					
	a) Biological signals	c) physical signals				
	b) chemical signals	d) electrical signals				
5.	The power needs of electrical transducers is					
	a) Maximum	c) Zero				
	b) <b>Minimum</b>	d) infinite				
6.	Electrical transducers are					
	a) Small and non-portable	c) small and compact				
	b) large and non-portable	d) large and portable				
7.	Mechanical transducers cause					
	a) Power loss	c) eddy current loss				
	b) hysteresis loss	d) frictional loss				
8.	Active transducers are classified into					
	a) 4 types	c) 6 types				
	b) 2 types	d) 8 types				
9.	Active transducers develops					
	a) Mechanical parameter	c) chemical parameter				
	b) electrical parameter	d) physical parameter				
10	.How do passive transducers develop electrical	signals?				
	a) Using a transformer	b) using internal source				



c) using external source	d) using a diode
11.In electromagnetic based transduction measures	_
a) converted into mechanical force	
b) converted into electromotive force	
c) converted into chemical force	
<b>d)</b> 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 con	
b) be same at all environment conditions	
c) be same at some environment condition	
<b>d)</b> be zero always	
14. The output of a transducer must be	
a) Low	c) High
b) Medium	<b>d</b> ) 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	<b>d)</b> very slow in response
17.The output of a transducer must	_
a) Be less reliable	c) not be reliable
b) be highly reliable	<b>d)</b> be of medium reliability
18. The range of a transducer is	
a) Medium	c) <b>Large</b>
b) Narrow	<b>d</b> ) 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 se	nsors?	
a) Touch sensitive	c) Input voltage	sensitive
b) Pressure sensitive	d) Humidity sen	sitive
21. Change in output of sensor with change in inp	ut is	_
a) Threshold	c) Sensitivity	
b) Slew rate	<b>d)</b> none of the m	entioned
22. Sensitivity of a sensor can be depicted by		
a) Niquist plot	c) <b>Bode plot</b>	
b) Pole- zero plot	<b>d)</b> none of the m	entioned
23. Smallest change which a sensor can detect is _		
a) <b>Resolution</b>	c) Precision	
b) Accuracy	d) Scale	
24. Which of the following is not an analog sensor	r?	
a) Potentiometer	c) Acceleromete	ers
b) Force-sensing resistors	d) None of the r	nentioned
25.Semiconductor used in sensors will be		
a) Pure form	c) Pure or dope	ed form
b) Doped form	d) none of the m	entioned
26. Which of the following represent active transd	lucer?	
a) Strain gauge	c) LVDT	
b) Thermistor	d) Thermocoup	le
27. Which transducer is known as 'self-generating	g transducer'?	
a) Active transducer	c) Secondary tra	nsducer
b) Passive transducer	d) Analog transc	lucer
28. What is the relation between scale factor and s	ensitivity of a trans	sducer?
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 transduce	r?	
a) Encoders	c) Digital tachor	neters
b) Strain gauge	d) Limit switch	
30. What is the principle of operation of LVDT?		
Prepared By: Prof. N. A. Gade (Department of E&TC Eng	gineering)	Page 35 of 36

#### Mar Ra Udoji

#### Maratha Vidya Prasarak Samaj's

#### Rajarshi Shahu Maharaj Polytechnic, Nashik

a) Mutual inductance	c) Permanence
b) Self-inductance	d) Reluctance
30. Which of the following can be measure	ed using Piezo-electric transducer?
a) Velocity	c) Force
b) Displacement	d)Sound
31. Capacitive transducer is used for?	
a) Static measurement	c) Transient measurement
b) <b>Dynamic measurement</b>	d) both static and dynamic
32. Which of the following is used in photo	o conductive cell?
a) Selenium	c) Rochelle salt
b) Quartz	<b>d)</b> Lithium sulphate
33. Which type of material can be sensed b	y inductive proximity sensor?
a) Wooden type	c) Plastic type
b) Metallic type	<b>d</b> ) Glass type
34. Which metal will have a larger range of	f detection by inductive proximity sensor?
a) <b>Iron</b>	c) Copper
b) Aluminum	<b>d</b> ) Lead
35. Which metal will have a larger range of	f detection by inductive proximity sensor?
a) Zinc	c) Copper
b) <b>Steel</b>	<b>d</b> ) Lead
36. Which is an example of infrared proxim	nity sensor?
a) GP2Y0A41SK0F	c) SLB700A/06VA
b) MCP793V-500	d) BMP180
37. Which type of proximity sensor can be	used as touch sensor?
a) Inductive proximity sensor	c) Ultrasonic proximity sensor
b) Capacitive proximity sensor	d) photoelectric proximity sensor
38. Which type of proximity sensor can det	tect a magnetic substance even if a wall of non-
ferrous substance is made?	
a) Magnetic proximity sensor	c) Ultrasonic proximity sensor
b) capacitive proximity sensor	d) photoelectric proximity sensor