THE
RADIO AMATEURS
QUESTION & ANSWER
REFERENCE MANUAL

R.E.G. PETRI. G8CCJ

SPECIALLY PREPARED FOR STUDENTS OF THE RADIO AMATEURS' EXAMINATION CONTAINING THE CITY & GUILDS OF LONDON INSTITUTE R.A.E. SYLLABUS, OVER 1,100 MULTIPLE CHOICE QUESTIONS & ANSWERS, AND USEFUL COMPUTER PROGRAMS

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PREFACE

I have compiled the 'Radio Amateurs' Q and A Reference Manual' primarily for the Radio Amateurs Examination (RAE) student.

It will also be a useful guide to the RAE lecturer, particularly the club lecturer who may be unfamiliar with the syllabus. The book will also provide a useful reference source of questions for an employer when interviewing potential technicians for certain branches of the electronics and services industries.

This book is structured to progress with any recognised course of instruction and it is arranged in the order that I lecture my own RAE students. The sections in this book follow the general syllabus with the exception that Electrical Theory has been broken down into nine separate sections instead of one, this is for ease of study. Each section is divided by an easily located black edged answer sheet.

This book will provide the guidelines for a complete RAE course lasting about 25 weeks, one section for each weeks lecture with the exception of sections 1, 12, 13 and 15 which normally require a minimum of 2 weeks each. The questions are not picked at random, they are selected, where possible, to be progressive, and to make the student read with purpose, into the various text books that are available.

I am reluctant to recommend any single book as providing adequate coverage for the examination. However, the books that I do recommend at the end of this preface, between them, will provide excellent coverage of the subject matter, nevertheless none of them provide a sufficient number if any, of structured questions with answers.

This Q and A Reference Manual will provide the necessary questions and answers and also provide a common link between the various books recommended.

There is a common belief that the RAE is easy and that any candidate has a 25% chance of passing. This is not true. The RAE thoroughly explores every nook and cranny of the students knowledge; the examination pattern given in appendix A shows how the examination is constructed.

The student who has no connection with the electronics industry is advised that one hour per day spent reading and practising examples may be required to obtain a reasonable grade of pass in the examination. This manual has been written to the depth that I consider necessary to achieve this goal.

I am constantly reminded that many students have difficulty obtaining practical experience, I would therefore advise students to join a good amateur radio club where the members are prepared to pass on their experience and demonstrate amateur radio communication at its best. Do not despise the use of legal Citizens Band radio as a means of getting on the air before obtaining an amateur licence. This will provide some excellent experience of setting-up a radio station, measuring output power, standing waves, voltages and adjusting and setting-up an antenna. However, from the students point of view, the operating practices, procedures and disciplines found on CB radio, are not typical of amateur radio.

The computer programs in section 21 are not part of the syllabus, they are included in the hope that the student will find them useful.

I must record my gratitude to the people who have helped make this book possible; my sons, Shaun G6SXV and Daniel, who both contributed so much in the preparation stages, and to all of my past and present RAE students for making me aware of the need for this book and proving the value of the questions contained within.

Acknowledgement and thanks must also go to the following for their valued comments and help with various sections:-

Andy Eskelson G8POY

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Brian Cannon G8DIU

John Rosser BSc.

Thanks are also due to; The City and Guilds of London Institute for permission to reproduce the material contained in appendix A.

The Department of Trade and Industry for discussing current licensing conditions.

Chartwell. H.W.Peel and Company Ltd. for supplying the cover background illustration.

Finally it should be noted that the questions and answers in this first edition are based on the City and Guilds syllabus and licensing conditions in force at the time of publication. It is intended that later editions will be revised if necessary.

The current City and Guilds syllabus is valid until the last examination in 1985, but it is likely that a revised scheme will be introduced for 1986. It should also be noted that these questions are not City and Guilds questions and no responsibility for their accuracy or otherwise can be attributed to the Institute.

ESSENTIAL READING:-

How to Become a Radio Amateur. (DTI) Available free of charge from- The RALU. Chetwynd House,
Chesterfield, Derbyshire. S49 1PF

(Section 20 of this Q&A manual has been designed with the object of making the student read deeply into the above publication.)

RECOMMENDED READING

This book.

The Radio Amateurs' Examination Manual	RSGB
Radio Communication Handbook	RSGB
Radio Handbook 21st Edition	W.I.Orr
The Radio Amateur's Handbook	ARRL
Passport to Amateur Radio	(Practical Wireless)
Out of Thin Air	(Practical Wireless)

REGP

1. D.C. CALCULATIONS

1. The unit of electrical pressure is the-

   a) Ohm   b) Volt   c) Amp   d) Watt

2. A current flow of one coulomb per second is referred to as the-

   a) Ohm   b) Volt   c) Amp   d) Watt

3. The unit of opposition to the flow of current is the-

   a) Ohm   b) Volt   c) Amp   d) Watt

4. Which of the following sets of materials are all electrical insulators?

a)	b)	c)	d)
Ceramic	Copper	Silver	Glass
Brass	Glass	Gold	Mica
Iron	Mica	Iron	Ceramic

5. Which of the above sets of materials are all electrical conductors?

6. Which one of the following statements is true?

   a) Only some materials have the property of electrical resistance.

   b) Only dry insulators have the property of electrical resistance.

   c) Only good conductors have the property of electrical resistance.

   d) All materials have the property of electrical resistance.

7. When an electric current flows in a resistor-

a) volts will flow in the external circuit.

b) the resistance value will increase.

c) the electron flow ceases.

d) energy is dissipated in the form of heat.

---

8. The unit of electrical power is the-

a) Ohm. b) Volt. c) Amp. d) Watt.

---

9. Ohms law calculations may be performed by using one of the following sets of formulae-

a)	b)	c)	d)
$I = V/R$	$I = V/R$	$I = R/V$	$I = R/V$
$V = IR$	$V = IR$	$V = R/I$	$V = I/R$
$R = I/V$	$R = V/I$	$R = V/I$	$R = V/I$

---

10. The power in Watts, dissipated by a resistor may be calculated from one of the following sets of formulae-

a)	b)	c)	d)
$W = V^2/R$	$W = V/R$	$W = V^2I$	$W = R/I$
$W = I^2R$	$W = IR$	$W = I^2V$	$W = IR$
$W = VI$	$W = VR$	$W = I^2R$	$W = R^2V^2$

---

11. What will happen to the current flowing in a circuit when the resistance is increased?

a) It will decrease.

b) It will increase.

c) Nothing.

d) It rises slightly and then returns to its previous value.

12.

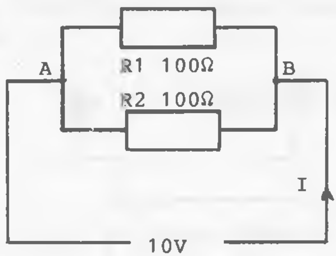


Fig.1

The resistors shown in fig.1 form a-

a) series circuit.

b) star circuit.

c) parallel circuit.

d) delta circuit.

---

13. The effective resistance of the circuit shown in fig.1 is given by the formula-

a) $\frac{R1}{R2}$ b) $R1 + R2$ c) $\frac{R1 \times R2}{R1 + R2}$ d) $\frac{R2}{R1}$

---

14. What is the effective resistance of the circuit shown in fig.1?

a) 2Ω b) 200Ω c) 50Ω d) 10kΩ

---

15. If a 10 volt supply is connected across points A and B in fig.1, the total supply current will be-

a) 10A b) 50mA c) 200mA d) 1mA

---

16. What is the current flowing in R1 fig.1?

a) 20A b) 1000mA c) 100mA d) 0·5mA

---

17. What is the current flowing in R2 fig.1?

a) 5A b) 400mA c) 250mA d) 100mA

18.

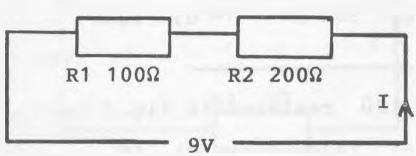


Fig.2

The resistors shown in fig.2 are connected as a-

a) series circuit.

b) parallel circuit.

c) delta circuit.

d) star circuit.

---

19. The efective resistance of the circuit shown in fig.2 is given by the formula-

a) $\frac{R1}{R2}$ b) R1 + R2 c) $\frac{R1 \times R2}{R1 + R2}$ d) $\frac{R2}{R1}$

---

20. The effective resistance of the circuit shown in fig.2 is-

a) 2 Ω b) 300 Ω c) 66·6 d) 7·07 Ω

---

21. A 9 volt supply is connected across the two resistors shown in fig.2. What is the total current flowing?

a) 3A b) 300mA c) 30mA d) 3mA

---

22. What is the current flowing in R2 fig.2?

a) 300mA b) 30mA c) 3mA d) 300μA

---

23. What is the current flowing in R1 fig.2?

a) 100mA b) 30mA c) 1·5mA d) 600μA

24.

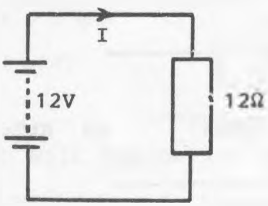


Fig.3

Referring to fig.3. What is the power dissipated in the 12Ω resistor?

a) 12W b) 144W

c) 24W d) 1W

---

25. For satisfactory and economic operation the power rating of the resistor shown in fig.3 should be about-

a) 1·5W b) 15W c) 30W d) 100W

---

26. The voltage developed across the 12Ω resistor in fig.3 is-

a) 12V b) 24V c) 144V d) 1V

27. The current flowing in the 12Ω resistor shown in fig.3 is-

a) 144A b) 24A c) 12A d) 1A

28.

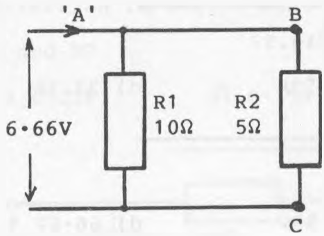


Fig.4

What is the effective resistance of the circuit shown in fig.4?

a) 66•6Ω

b) 6•66Ω

c) 50Ω

d) 3•33Ω

---

29. What is the current flowing in R1 fig.4?

a) 66•6A b) 6•66A c) 0•66A d) 1•33A

---

30. What is the current flowing in R2 fig.4?

a) 33•3A b) 0•75A c) 0•66A d) 1•33A

---

31. Referring to fig.4. If an ammeter is inserted in the circuit at point A, it will indicate a total current of-

a) 1A b) 2A c) 5A d) 10A

---

32. What voltage would you expect to measure across points B and C fig.4?

a) 1•33V b) 2•66V c) 3•33V d) 6•66V

33.

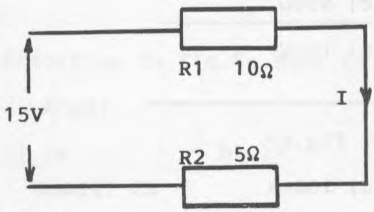


Fig.5

What is the total resistance of the circuit shown in fig.5?

a) 3•33Ω

b) 15Ω

c) 50Ω

d) 66•6Ω

34. What is the total current flowing in the circuit shown in fig.5?

a) 1A   b) 15A   c) 50A   d) 66·6A

35. What is the current flowing in R2 fig.5?

a) 1A   b)'15A   c) 50A   d) 33.3A

36. The p.d. across R2 fig.5 is-

a) 5V   b) 15V   c) 50V   d) 66·6V

37. The p.d. across R1 fig.5 is-

a) 5V   b) 10V   c) 25V   d) 50V

38. The power dissipated in R2 fig.5 is-

a) 5W   b) 10W   c) 15W   d) 50W

39. The total power dissipated in the circuit shown in fig.5 is-

a) 5W   b) 10W   c) 15W   d) 50W

40.

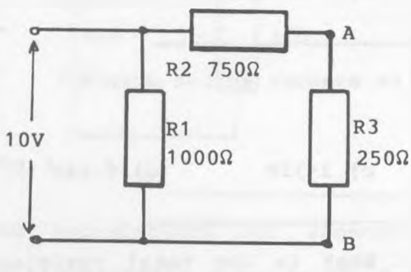


Fig.6

What is the effective resistance of the circuit shown in fig.6?

a) 2000Ω

b) 1000Ω

c) 500Ω

d) 100Ω

41. What is the current flowing in R1 fig.6?

a) 1mA   b) 10mA   c) 100mA   d) 1000mA

42. What is the current flowing in R2 fig.6?

a) 1mA b) 10mA c) 100mA d) 1000mA

---

43. Referring to fig.6. What is the p.d. between points A and B?

a) 0•25V b) 0•75V c) 2•5V d) 7•5V

44.

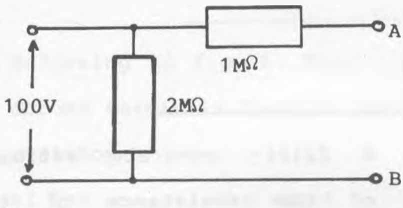


Fig.7

Referring to fig.7. What is the p.d. between points A and B?

a) 33•3V b) 66•6V

c) 10V d) 100V

---

45. Referring to fig.7. What is the current flowing in the 1MΩ resistor?

a) 200μA b) 100μA c) 1μA d) Zero

46.

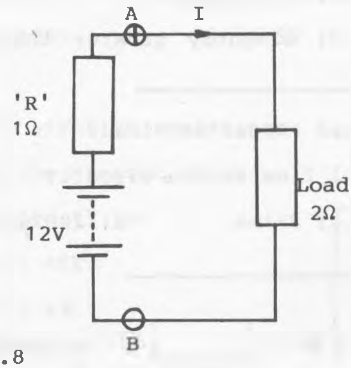


Fig.8

The 12 volt battery shown in fig.8 has an internal resistance 'R' of 1Ω. What will be its terminal voltage when a 2Ω load is connected?

a) 3V b) 4V

c) 8V d) 12V

---

47. Referring to fig.8. What is the current flowing in the 2Ω load?

a) 1A b) 2A c) 4A d) 12A

48. A cursory glance at the circuit shown in fig.9 should enable you to estimate that the effective resistance is-

a) about 500Ω

b) greater than 3000Ω

c) greater than 2·1Ω

d) less than 2·1Ω

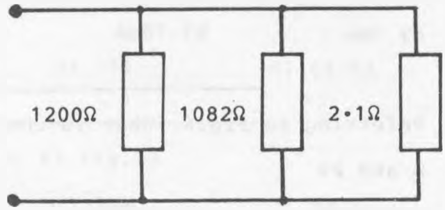


Fig.9

49.

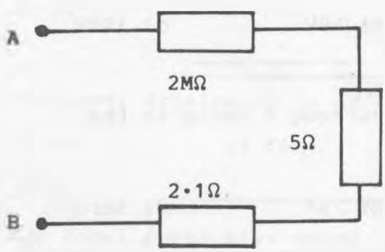


Fig.10

A fairly accurate estimate of the resistance of the circuit shown in fig.10 would be-

a) about 2MΩ

b) less than 2MΩ

c) less than 2·2Ω

d) slightly greater than 2·1Ω

---

50. A voltage of 1000 volts is applied across terminals A and B fig.10. What current will flow in the circuit?

a) 500μA b) 1000μA c) 2·1mA d) 2007μA

---

51. Referring to fig.11. The effective resistance, measured across points A and B is approximately-

a) 120kΩ b) 121kΩ

c) 128kΩ d) 8Ω

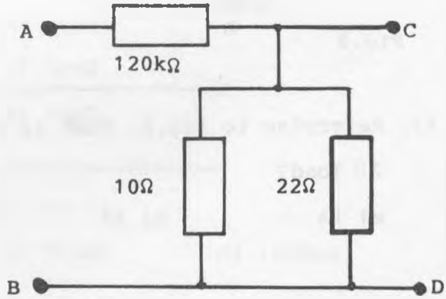


Fig.11

52. Referring to fig.11. The effective resistance measured across points C and D is-

a) 121kΩ b) 6·87Ω c) 32Ω d) 22Ω

---

53. Referring to fig.11. A supply of 120 volts is connected across points C and D. What is the p.d. across points A and B?

a) 120mV b) 22V c) 120V d) Zero

---

54. Referring to fig.11. When a supply of 120 volts is connected across terminals C and D, what current will flow in the 120kΩ resistor-

a) 1mA b) 120μA c) 12μA d) Zero

---

55. Referring to the circuit shown in fig.11. A voltmeter having a sensitivity of 1000Ω/V, is switched to the 100 volt range and connected across points A and B. What will the meter read when a 100 volt supply is connected across points C and D?

a) 100V b) 54·5V c) 45·5V d) Zero

---

56. The efective resistance of the circuit shown in fig.12 is-

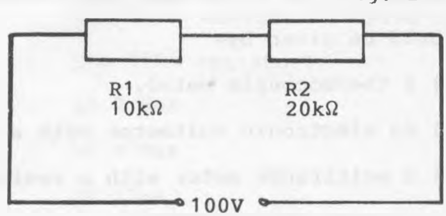
a) 6·66kΩ

b) 21kΩ

c) 30kΩ

d) 66kΩ

Fig.12



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57. What is the p.d. developed across R2 fig.12?

a) 66·6V b) 33·3V c) 50V d) 100V

58. A multirange voltmeter with a sensitivity of 200Ω/v is switched to the 100 volt range in order to check the p.d. across R2 fig.12. What will the meter indicate?

a) 66•6V b) 33•3V c) 50V d) 100V

---

59. If the meter reading is different in question 58 from the calculated value in question 57, this will be due to-

a) the stray magnetic field of the meter.

b) temperature rise in the meter coil.

c) ageing of the resistors.

d) the resistance of the meter.

---

60. From the answers to questions 57 and 58, any differences between the calculated value and the measured value may be reduced by-

a) fitting heat sinks on the meter coil.

b) increasing the sensitivity of the meter.

c) reducing the sensitivity of the meter.

d) shunting the meter with a diode.

---

61. Referring to Q 58. The most accurate indication of the p.d. would be given by-

a) a thermocouple meter.

b) an electronic voltmeter with a resistance of 100MΩ

c) a multirange meter with a resistance of 100kΩ

d) a spark gap voltmeter.

62. Referring to fig.13. What is the power dissipated in resistor R2?

a) 2·5W b) 5W

c) 250W d) 500W

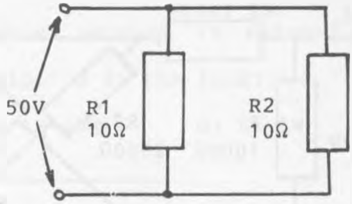


Fig.13

63. What is the total power dissipated by the circuit shown in fig.13?

a) 2·5W b) 5W c) 250W d) 500W

64. Referring to fig.13. Power is dissipated in the form of-

a) heat. b) magnetic radiation.

c) current flow. d) U.V. light.

65. If the resistor R2 in fig.13 is disconnected, the power dissipated in R1 will-

a) remain the same. b) double.

c) halve. d) increase four times.

66.

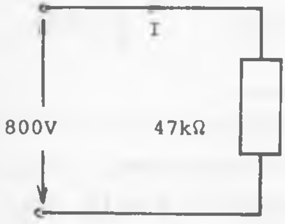


Fig.14

Referring to fig.14. What is the current flowing in the 47kΩ resistor?

a) 376mA

b) 470mA

c) 17mA

d) 58·4mA

67. Referring to fig.14. What is the power dissipated by the 47kΩ resistor?

a) 746W b) 37·6W c) 13·6W d) 3·76W

68.

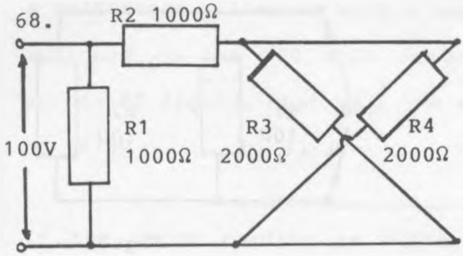


Fig.15

Using a high resistance voltmeter, what voltage would you expect to measure across R1 fig.15?

a) 100V b) 50V

c) 20V d) 10V

---

69. What p.d. is developed across R2 fig.15?

a) 100V b) 50V c) 20V d) 10V

---

70. What is the current flowing in R1 fig.15?

a) 100mA b) 50mA c) 25mA d) 2·5mA

---

71. What is the current flowing in R3 fig.15?

a) 0·1A b) 50mA c) 25mA d) 2·5mA

---

72. Referring to fig.16. The power dissipated by the non-inductive load 'R' is 150 watts. What current will be indicated on the ammeter 'A'?

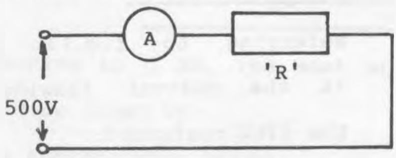


Fig.16

a) 0·3A b) 1A

c) 150A d) 500A

73.

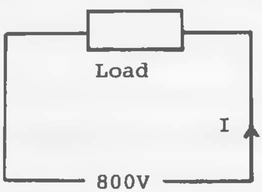


Fig.17

Referring to fig.17. The current in the load is 187mA. What is the power dissipated by the load?

a) 18·7W b) 80W

c) 150W d) 187W

74. Referring to fig.17. If the applied voltage is reduced to 400 volts, what power will be dissipated in the load?

a) 4·3W b) 8·9W c) 12·25W d) 37·5W

75. What is the p.d. between points A and B in fig.18?

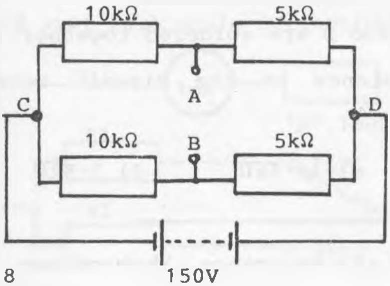


Fig.18

a) 150V

b) Zero

c) 50mA

d) 25mA

76. What is the p.d. between points C and D fig.18?

a) 150V b) 100V c) 50V d) Zero

77. Referring to fig.18. What is the current flowing in the upper branch of the circuit?

a) Zero b) 10mA c) 15mA d) 150mA

78. The direction of conventional current flow in the circuit shown in fig.18 is from-

a) C to D b) A to B c) B to A d) D to C

79. The direction of electron flow in the circuit shown in fig.18 is from-

a) C to D b) A to B c) B to A d) D to C

80. What power is dissipated in each of the 5KΩ resistors used in the circuit of fig.18?

a) 0·5W b) 1W c) 1·5W d) 3W

81. Referring to fig.18. What is the total power dissipated in the circuit?

a) 1·5W b) 3W c) 4·5W d) 6W

---

82. Referring to fig.18. Points A and B are soldered together. What is the effective resistance of the circuit between points C and D?

a) 50kΩ b) 25KΩ c) 12·5kΩ d) 7·5kΩ

---

83. Fig.19 shows a 5kΩ resistor of ±5% tolerance. What colour code will it have?

a) Green Black Red Gold

b) Green Red Black Gold

c) Gold Black Red Green

d) Green Gold Red Black

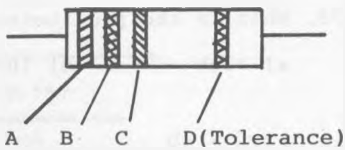


Fig.19

---

84. The minimum power rating for the 10kΩ resistors in fig.18 should be-

a) 0·5W b) 1W c) 1·5W d) 5W

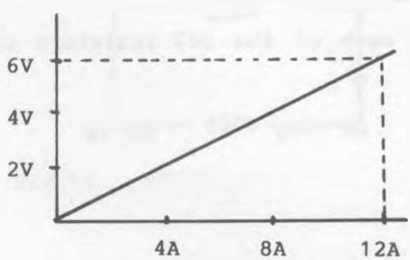
---

85. The actual value of a 1kΩ 5% tolerance resistor will be between-

a) 995 - 1005Ω b) 999 - 1001Ω

c) 950 - 1050Ω d) 997 - 1003Ω

86.



A graph is plotted of the current/voltage relationship in a d.c. circuit. What is the resistance of the circuit?

a) 72Ω b) 2Ω

c) 0·5Ω d) 0·12Ω

87. Fig.19 shows the basic configuration for a moving coil voltmeter, the meter movement has a full scale deflection of 1mA, and a resistance 'r' of 100Ω.

What value is required for R1 to give the instrument a 10 volt full scale deflection range?

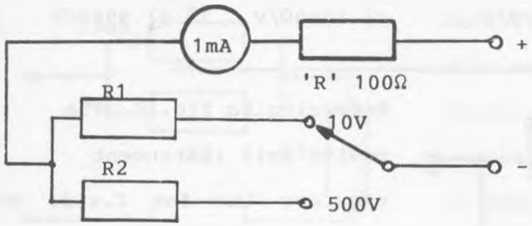


Fig.19

a) 100Ω

b) 1000Ω

c) 10,000Ω

d) 9,900Ω

---

88. What resistance will the voltmeter shown in fig.19 present to the circuit that it is measuring when it is switched to the 10 volt range?

a) 100Ω b) 1000Ω c) 10,000Ω d) 9,900Ω

---

89. When the voltmeter shown in fig.19 is switched to the 10 volt range and shows a full scale deflection, the current flowing in the instrument coil will be-

a) 1mA b) 1·1mA c) 10mA d) 9·9mA

---

90. When the voltmeter shown in fig.19 is switched to the 500 volt range, and is connected across a 250 volt supply, what current will flow in the instrument coil?

a) 0·5mA b) 2·5mA c) 25mA d) 500mA

---

91. Referring to fig.19. What value of R2 is required to give the instrument a 500 volt full scale deflection range?

a) 499·9Ω b) 5000Ω c) 5900Ω d) 499,900Ω

92. The power rating for the range multiplier R2 fig.19 should be at least-

a) 0•5W b) 4•9W c) 5W d) 49W

---

93. The sensitivity of the instrument shown in fig.19 is-

a) 100Ω/V b) 200Ω/V c) 1000Ω/V d) 999Ω/V

94.

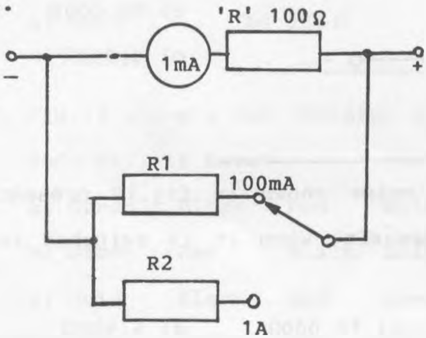


Fig.20

Referring to fig.20. The moving coil instrument requires 1mA for f.s.d. and has an internal resistance of 100Ω. What value should R1 be to give a 100mA f.s.d. range?

a) 101Ω b) 100Ω

c) 10•1Ω d) 1•01Ω

---

95. When the instrument shown in fig.20 is switched to the 1 amp f.s.d. range, the value of the shunt resistor R2 must be-

a) 10•1Ω b) 10Ω c) 1•001Ω d) 0•1001Ω

---

96. Referring to fig.20. What is the current flowing in R2 when the meter is switched to the 1 amp range and showing a half scale deflection?

a) 999mA b) 499•5mA c) 99mA d) 49•5mA

97. Referring to fig.20. When the instrument is switched to the 1 amp range, and showing a full scale deflection, what power is dissipated in the shunt resistor R2? Approximately-

a) 0•1W b) 0•8W c) 0•99W d) 9•9W

98.

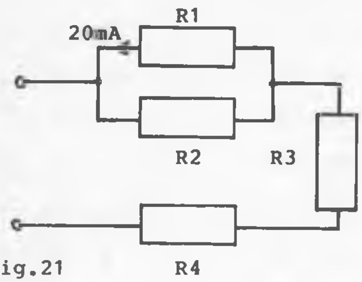


Fig.21

Referring to fig.21.

All resistors have the same value. What is the total current flowing in the circuit?

a) 10mA b) 20mA

c) 40mA d) 80mA

---

99. In fig.21, the p.d. across R3 is 10 volts.

What is the supply voltage applied at points A and B?

a) 10V b) 15V c) 20V d) 25V

100.What is the current flowing in R3 fig.21?

a) 10mA b) 20mA c) 40mA d) 80mA

101.What is the resistance of R4 fig.21?

a) 125Ω b) 250Ω c) 500Ω d) 625Ω

1. D.C. CALCULATIONS

1	b	31	b	61	b	91	d
2	c	32	d	62	c	92	a
3	a	33	b	63	d	93	c
4	d	34	a	64	a	94	d
5	c	35	a	65	a	95	d
6	d	36	a	66	c	96	b
7	d	37	b	67	c	97	a
8	d	38	a	68	a	98	c
9	b	39	c	69	b	99	d
10	a	40	c	70	a	100	c
11	a	41	b	71	c	101	b
12	c	42	b	72	a		
13	c	43	c	73	c		
14	c	44	d	74	d		
15	c	45	d	75	b		
16	c	46	c	76	a		
17	d	47	c	77	b		
18	a	48	d	78	d		
19	b	49	a	79	a		
20	b	50	a	80	a		
21	c	51	a	81	b		
22	b	52	b	82	d		
23	b	53	c	83	a		
24	a	54	d	84	b		
25	b	55	c	85	c		
26	a	56	c	86	c		
27	d	57	a	87	d		
28	d	58	c	88	c		
29	c	59	d	89	a		
30	d	60	b	90	a		

2. ALTERNATING CURRENTS

1. An alternating current or voltage is one that-
   a) periodically reverses, with 2 complete reversals per cycle.
   b) periodically reverses, with 1 complete reversal per cycle.
   c) randomly reverses, with 1 complete reversal per second.
   d) *randomly reverses, with 2 complete reversals* per second.

---

2. The waveform shown in fig.1 is a-
   a) sawtooth wave.
   b) stationary wave.
   c) speech wave.
   d) sine wave.

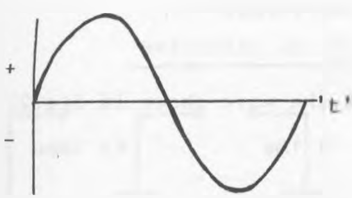


Fig.1

---

3. If 1000 complete cycles of the waveform shown in fig.1 occur in 1 second, the frequency of the waveform is-

   a) 0·01Hz　　b) 1Hz　　c) 1kHz　　d) 10kHz

---

4. Referring to Q 3. What is the periodic time of the wave?

   a) 100s　　b) 1s　　c) 1ms　　d) 10μs

---

5. The sine wave shown in fig.1 could have been generated by which one of the following-
   a) an alternator.
   b) a 9V battery and a reversing switch.
   c) a ni-cad battery and a length of transmission line.
   d) a d.c. generator.

6. It is possible to generate sine waves by methods other than that referred to in Q 5, one is-

a) a transistor L/C oscillator.

b) a negative feedback amplifier.

c) an alternating current battery and silicon diode.

d) a square wave multivibrator.

---

7. What is the frequency of the wave shown in fig.2?

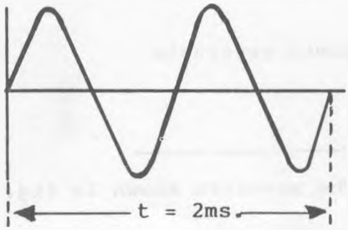


Fig.2

a) 200kHz

b) 2kHz

c) 1kHz

d) 0·1kHz

---

8. What is the periodic time 't' of the wave shown in fig.2?

a) 0·002ms   b) 2ms   c) 1ms   d) 10ms

---

9. The periodic time 't' of a waveform is 2ms.

What is the frequency?

a) 500Hz   b) 1kHz   c) 2000Hz   d) 10kHz

---

10. The periodic time 't' of a waveform is 1μs.

What is the frequency?

a) 500kHz   b) 1MHz   c) 2MHz   d) 10MHz

---

11. A sine wave will repeat itself every-

a) 90^{0} b) 180^{0} c) 270^{0} d) 360^{0}

12. Which one of the following pairs of terms describe the amplitude of a sine wave?

a) periodic-inductive.

b) sine-capacitive.

c) peak-r.m.s.

d) VSWR-RFI.

---

13. The peak value of a sine wave is 1·4V. What is the r.m.s. value?

a) 2·8V b) 1·4V c) 1·0V d) 0·707V

---

14. The r.m.s. value of a sine wave is 70·7V. What is the peak value?

a) 280V b) 140V c) 100V d) 70·7V

---

15. Referring to fig.3. A 200V d.c. power supply provides the power to a 50Ω non-inductive load 'R'. What would be the peak voltage of a sine wave generator need to be to provide the same power as the d.c. supply into the load?

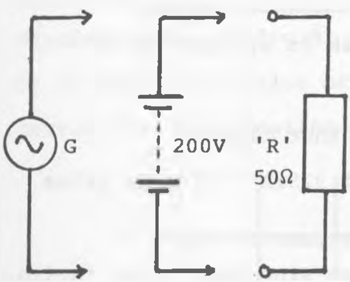


Fig.3

a) 282V b) 200V

c) 141V d) 70·7V

---

16. A sinusoidal current of 10 amps, alternates at a frequency of 50Hz. What is its value 0·005s after its zero value?

a) Zero b) 5A c) 10A d) 20A

---

17. A sine wave of 100V peak, has a frequency of 50Hz. What is its value 10ms after its zero value?

a) Zero b) 50V peak c) 100V peak d) 200V peak

18. An alternating voltage of r.m.s. value 230V has a peak value of-

a) 162·6V b) 250V c) 325V d) 460V

---

19. An alternating voltage of 300V r.m.s. is connected across a pure resistance of 6000Ω. What is the r.m.s. current?

a) 2·8A b) 1·4A c) 1A d) 0·05A

---

20. When an alternating supply is connected across a non-inductive resistor-

a) the current and voltage will be in phase.

b) the current will lag the voltage by 90°.

c) the current will lead the voltage by 90°.

d) there will be a 180° phase shift.

---

21. An alternating voltage of 325V peak is applied to a non-inductive load of 10kΩ.

What is the peak value of current that flows?

a) 32·5mA b) 230mA c) 325mA d) 707mA

22.

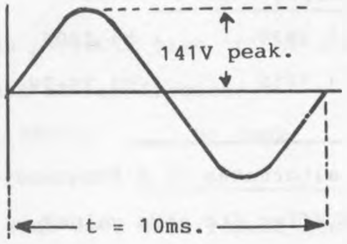


Fig.4

The sine wave shown in fig.4 has a peak-peak value of-

a) 282V

b) 325V

c) 200V

d) 141V

---

23. The frequency of the sine wave shown in fig.4 is-

a) 10Hz b) 100Hz c) 1000Hz d) 10,000Hz

24. What is the r.m.s. value of the voltage in fig.4, 2·5ms after the start of a cycle?

a) +100V b) +141V c) -100V d) -141V

---

25. The average value of a sine wave is-

a) 2 x V r.m.s. b) 0·707 x V r.m.s.

c) 2 x V peak. d) 0·637 x V peak.

---

26. The abbreviation 'r.m.s.' stands for-

a) root mean square.

b) resistive mean sum.

c) reactive maximum sine.

d) reactive mean standard.

---

27. An alternating current having the perfectly rectangular waveform shown in fig.5, has a peak or maximum value of 10 amps. What value of d.c. current would be needed to provide the same heating effect in a non-reactive load?

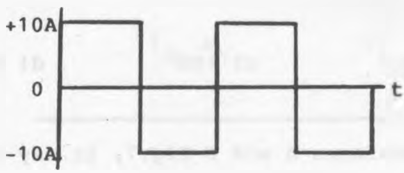


Fig.5

a) 7·07A

b) 10A

c) 14·1A

d) 28.2A

---

28. Fig.6 shows a complex waveform, it consists mainly of-

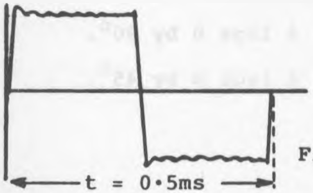


Fig.6

a) fundamental frequency plus all harmonics.

b) fundamental frequency with no harmonics.

c) even harmonics with no fundamental frequency.

d) fundamental frequency plus odd harmonics.

29. The fundamental frequency of the waveform fig.6 is-

a) 500Hz b) 1000Hz c) 2000Hz d) 4000Hz

30. The 3rd harmonic of the waveform fig.6 is-

a) 1·5kHz b) 3kHz c) 6kHz d) 12kHz

31. The 7th harmonic of the waveform fig.6 is-

a) 7kHz b) 14kHz c) 21kHz d) 28kHz

32.

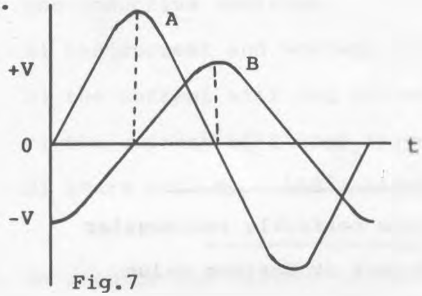


Fig.7

Fig.7 shows 2 voltage waveforms of the same frequency, they differ in-

a) phase and frequency.

b) voltage and phase.

c) wavelength and velocity.

d) none of the above.

33. The phase difference between the two waveforms shown in fig.7 is-

a) 360^{o} b) 300^{o} c) 180^{o} d) 90^{o}

34. Referring to the 2 waveforms A and B fig.7, it may be said that-

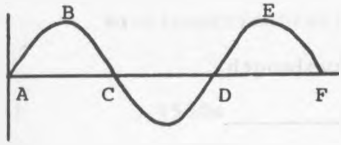
a) A leads B by 90^{o}. b) A lags B by 90^{o}.

c) B lags A by 180^{o}. d) A lags B by 45^{o}.

2. ALTERNATING CURRENTS

1	a	18	c
2	d	19	d
3	c	20	a
4	c	21	a
5	a	22	a
6	a	23	b
7	c	24	a
8	c	25	d
9	a	26	a
10	b	27	b
11	d	28	d
12	c	29	c
13	c	30	c
14	c	31	b
15	a	32	b
16	c	33	d
17	a	34	a

3. WAVELENGTH

1. 

The wavelength 'λ', of the wave shown in fig.1, may be described as-

Fig.1

a) the length of time taken for the wave to decay to zero.

b) the average amplitude of fluctuations at time zero.

c) the distance between two identical points on successive cycles of the wave, such as B - E.

d) the velocity at which points A - C of the wave pass a given reference point.

---

2. If the frequency of a wave is known, the wavelength may be calculated by one of the following formulae-

a) $\dfrac{f}{3 \times 10^8}$ b) $\dfrac{f}{2} \times 10^8$

c) $\dfrac{2f}{3 \times 10^8}$ d) $\dfrac{3 \times 10^8}{f}$

---

3. A radio station is listed as broadcasting on a wavelength of 208 metres, but your receiver is calibrated in 'kHz'. To what frequency would you tune the receiver to receive the broadcast?

a) 1·442kHz b) 14·4MHz c) 1442·3kHz d) 624kHz

---

4. It is typical of your luck, to be given the frequency of a transmission, 10·5MHZ, when your receiver has its dial marked in metres. To what wavelength will you tune the receiver for this transmission?

a) 28·57m b) 14·29m c) 7·14m d) 3150m

5. Given the following list of frequencies, calculate the wavelengths.

	Frequency	Wavelength
a)	1·875MHz	________
b)	2·0MHz	________
c)	3·75MHz	________
d)	4·0MHz	________
e)	5·0MHz	________
f)	10·0MHz	________
g)	15·0MHz	________
h)	21·0MHz	________
i)	28·0MHz	________
j)	30·0MHZ	________
k)	150·0MHz	________
l)	428·6MHz	________

---

6. What formula did you use for the above calculations?

a) $\frac{300 \times 10^6}{f}$

b) $\frac{300 \times 10^6}{2f}$

c) $300 \times 10^8 \times f$

d) $\frac{f}{300 \times 10^6}$

7. Given the wavelength, calculate the frequency of the following.

	Wavelength(metres)	Frequency
a)	1500m	________
b)	498m	________
c)	207m	________
d)	100m	________
e)	50m	________
f)	30m	________
g)	40m	________
h)	37•5m	________
i)	18m	________
j)	5m	________
k)	3m	________
l)	1m	________
m)	0•5m	________

3. WAVELENGTH

1	c	6	a
2	d	7a	200kHz
3	c	b	602kHz
4	a	c	1449kHz
5a	160m	d	3MHz
b	150m	e	6MHz
c	80m	f	10MHz
d	75m	g	7·5MHz
e	60m	h	8MHz
f	30m	i	16·66MHz
g	20m	j	60MHz
h	14·28m	k	100MHz
i	10·7m	l	300MHz
j	10m	m	600MHz
k	2m		
l	70cm		

4. CAPACITANCE

1. The unit of capacitance is the-

   a) Henry. b) Joule. c) Coulomb. d) Farad.

---

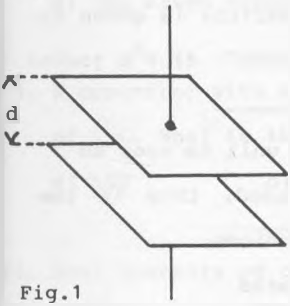
2. 

Fig.1

Fig.1 shows a parallel plate capacitor. When the distance 'd' is increased, the capacitance will-

   a) increase.
   b) decrease.
   c) remain the same.
   d) increase slightly, then return to its original value.

---

3. The working voltage of a capacitor is dependent upon the-

   a) area of the plates.
   b) thickness of the plates.
   c) dielectric strength of the insulating material and the distance 'd' between the plates.
   d) thickness of the wires connected to the plates.

---

4. The value of capacitance of the capacitor shown in fig.1 may be increased by-

   a) reducing the area of the plates and increasing the distance 'd'.
   b) placing it in a vacuum.
   c) using pure silver for the dielectric.
   d) using mica for the dielectric and decreasing the distance 'd' between the plates.

---

5. The formula for the charge 'Q' coulombs, on a capacitor is-

   a) $Q = CV$ b) $Q = \frac{CV^2}{2}$ c) $Q = C^2V$ d) $Q = V^2C$

6. Which type of capacitor has the greatest capacity per unit volume?

a) Mica. b) Air spaced. c) Oil filled. d) Electrolyti

---

7. The energy W, stored in the field of a capacitor is given by-

a) CV joules b) $\frac{CV^2}{2}$ joules c) C^2V joules d) V^2C joules

---

8. The unit of capacitance is rather a large unit to use, so a smaller and more practical unit is used, this is the-

a) microhenry. b) microcoulomb.

c) microjoule. d) microfarad.

---

9. A microfarad 'µF' is equal to-

a) 1×10^{-3}F b) 1×10^{-6}F

c) 1×10^{-9}F d) 1×10^{-12}F

---

10. A picofarad 'pF' is equal to-

a) 1×10^{-3}F b) 1×10^{-12}F

c) 1×10^{-6}F d) 1×10^{-9}F

---

11. Considering cost and standard practice, what type of capacitor would be the most suitable for smoothing a 250V d.c. power supply?

a) Mica. b) Air spaced.

c) Oil filled d) Electrolytic.

---

12. A typical value for a silver mica capacitor, used for tuning the R.F. stages of a V.H.F. receiver operating at a frequency of 145MHz, may be about-

a) 0·001pF b) 10pF c) 10µF 100µF

13. Capacitors exist in various shapes, sizes and values, but they are normally classified by-

a) the material used for the dielectric.

b) the volume to capacitance ratio.

c) the working voltage.

d) the rated ripple current.

---

14. A capacitor with a value of 0·001µF, receives a charge of 1µC. What is the p.d. across the plates?

a) 10V b) 100V c) 1000V d) 1500V

---

15. What quantity of charge 'Q' coulombs will produce a potential difference of 200V across the plates of a 5µF capacitor?

a) 1000µC b) 100µC c) 10µC d) 1·0C

---

16. A 2µF capacitor is charged to a p.d. of 1000 volts across its plates. What is the energy stored in the capacitor?

a) 1×10^{-6}J b) 1×10^{-3}J c) 1×10^{-1}J d) 1J

---

17. A 1000pF capacitor is charged to a p.d. of 1000V. What is the energy stored in the capacitor and the charge in coulombs?

a) 0·0005J 1µC b) 0·005J 10µC c) 1×10^{3}J 5×10^{-3}C d) 25×10^{-3}J 25×10^{-3}C

---

18. What is the total or effective capacitance of the circuit shown in fig.2?

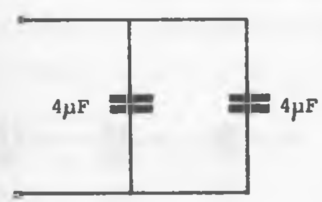


Fig.2

a) 2µF b) 4µF

c) 8µF d) 16µF

19. What is the total capacitance of the circuit shown in fig.3?

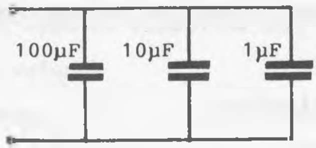


Fig.3

a) 0·101µF b) 10·1µF

c) 1101µF d) 111µF

---

20. The effective capacitance of the circuit shown in fig.4 is-

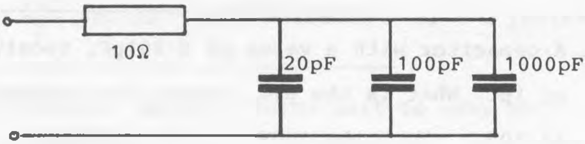


Fig.4

a) 1,120pF

b) 1,220pF

c) 18pF

d) 10pF

---

21. The total or effective capacitance of the series connected circuit of fig.5 is-

Fig.5

a) 100pF b) 200pF

c) 10pF d) 5pF

---

22. The total capacitance of the circuit shown in fig.6 is-

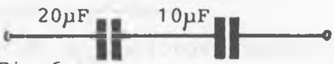


Fig.6

a) 200µF b) 30µF

c) 15µF d) 6·66µF

---

23. The total capacitance of the the circuit shown in fig.7 is-

Fig.7

a) 200,000pF b) 2100pF

c) 95·23pF d) 9·523pF

---

24. What is the total capacitance of the circuit shown in fig.8?

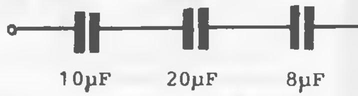


Fig.8

a) 3·63µF b) 5·32µF

c) 38µF d) 1600µF

25. The total capacitance of the circuit shown in fig.9 is-

a) 2·5μF b) 5μF

c) 10μF d) 25μF

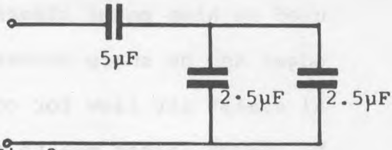


Fig.9

26. What is the total capacitance of the circuit shown in fig.10, measured across A - B?

a) 302·2μF b) 30·22μF

c) 12·22μF d) 10μF

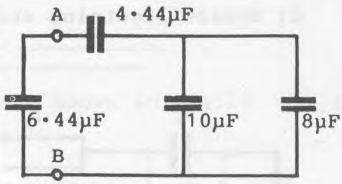


Fig.10

27.

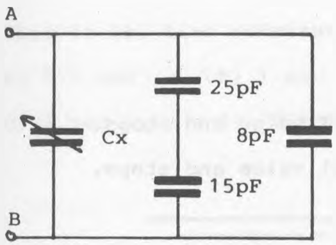


Fig.11

Cx is a variable air spaced capacitor. to what value would it have to be adjusted to make the total capacitance across A - B equal 30pF?

a) 20·625pF b) 17·375pF

c) 12·625pF d) 9·375pF

28. To what value would Cx have to be adjusted to make the total capacitance, across A - B fig.11, equal to 109·375pF?

a) 79·375pF b) 92pF c) 96·75pF d) 100pF

29. The total capacitance of the circuit shown in fig.12 is-

a) 20μF

b) 88μF

c) 12·8μF

d) less than 1μF

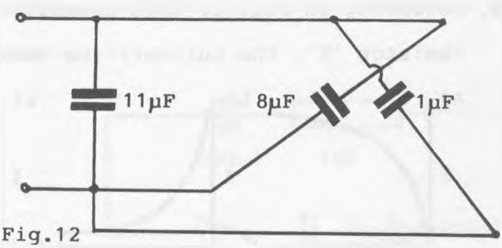


Fig.12

30. The plates of high quality, air spaced, variable capacitors used in high power stages of transmitters may have rounded edges and no sharp corners or projections, this is to-

a) assist air flow for cooling.

b) reduce losses due to corona discharge.

c) prevent injury to the operator.

d) bypass lightning strikes on the antenna.

---

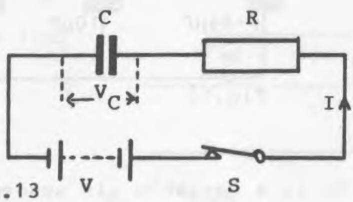
31. 

Fig.13

When a capacitor is charged via a resistor, as shown in fig.13, the charging current, I-

a) decreases exponentially.

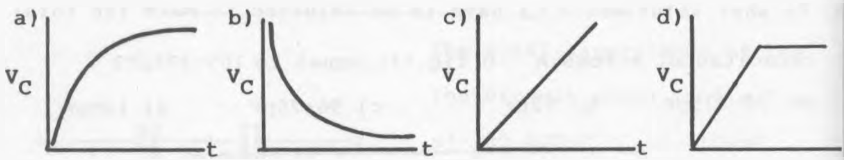
b) increases exponentially.

c) decreases to 37% of the initial value and stops.

d) decreases to 63% of the initial value and stops.

---

32. Referring to fig.13. When capacitor 'C' is charged via resistor 'R', the voltage/time curve is shown below as-



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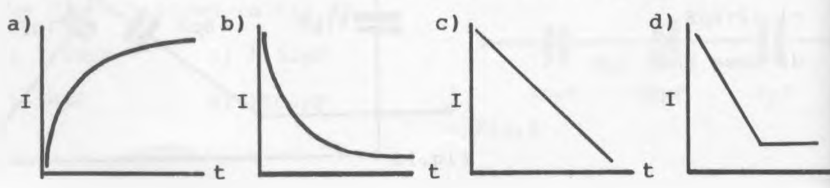
33. Referring to fig.13. When capacitor 'C' is charged via resistor 'R', the current/time curve is shown below as-



34. The 'time constant' of a C R circuit as shown in fig.13 is the time taken for the capacitor to-

a) reach full charge.

b) reach 98% of its full charge.

c) reach 63% of its full charge.

d) reach 37% of its full charge.

---

35. The 'time constant' of the C R circuit shown in fig.13 is given by the formula-

a) $t = CR$ b) $t = \frac{C}{R}$ c) $t = \frac{R}{C}$ d) $t = \frac{CR}{7 \cdot 07}$

---

36. What is the time constant of the R C circuit shown in fig.14

a) 0·5 sec b) 1 sec

c) 2 sec d) 10 sec

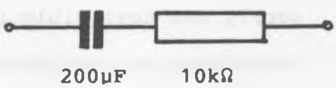


Fig 14

---

37. What is the time constant of the R C circuit shown in fig.15

a) 2 sec b) 10 sec

c) 100 sec d) 200 sec

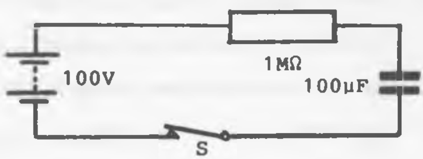


Fig.15

---

38. 200 seconds after switch 'S' is closed, the p.d. across the capacitor will be about-

a) 37 volts.

b) 63 volts.

c) 100 volts.

d) zero.

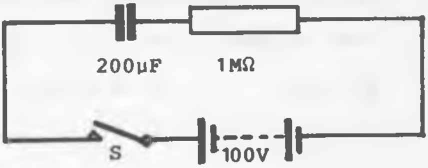


Fig.16

39. For practical purposes, a capacitor, when charged via a series resistor, may be considered fully charged in a time of-

a) C R sec b) 2 C R sec c) 5 C R sec d) 100 C R sec

---

40. What is the 'time constant' of the circuit shown in fig.17?

a) 100 sec.

b) 400 sec.

c) 500 sec.

d) 1000 sec.

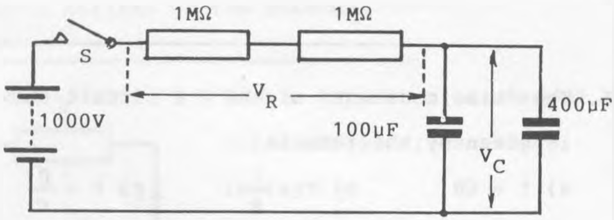


Fig 17

---

41. What current will flow in the circuit shown in fig.17 at the instant switch 'S' is closed? It may be assumed that the supply has negligible internal resistance and that the capacitors are initially discharged.

a) 0·5mA b) 0·63mA c) 100mA d) 500mA

---

42. Referring to fig.17, and assuming that the capacitors are initially discharged. What is the p.d. across the capacitors, Vc, at the instant switch 'S' is closed?

a) Zero. b) 370V c) 630V d)1000V

---

43. Referring to fig.17, and assuming that the capacitors are initially discharged. What current will flow in the circuit 1000 seconds after switch 'S' has been closed?

a) Zero. b) 0·185mA c) 0·630mA d) 1mA

44. Referring to fig.17 and assuming that the capacitors are initially discharged. What is the p.d. across the resistors, V_R, at the instant switch 'S' is closed?

a) 1000V b) 630V c) 370V d) Zero.

---

45. Referring to fig.18. With switch 'S' closed, the capacitor is charged via resistor 'R' for at least 5CR seconds. Then a voltmeter with a sensitivity of 1000Ω/V is switched to the 1000V f.s.d. range and connected across points A - B, the meter reading will-

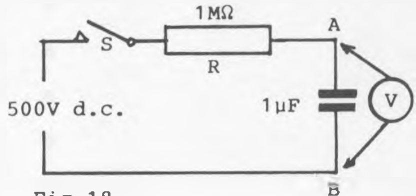


Fig.18

a) rise rapidly to 500V and then fall slowly to 250V.

b) rise rapidly to 500V and remain steady.

c) rise slowly to 500V and remain steady.

d) rise rapidly to 250V and then increase slowly to 500V.

---

46. Referring to fig.18. Initially switch 'S' is open and the capacitor fully discharged. The same voltmeter as in Q 45 is connected across the capacitor.
When switch 'S' is closed, the voltmeter reading will-

a) rise slowly to 500V and remain steady.

b) rise rapidly to 500V and then decrease slowly to zero.

c) rise slowly to 1000V and remain steady.

d) rise slowly to 250V and remain steady.

4. CAPACITANCE

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

5. CAPACITIVE REACTANCE

1. The opposition to current flow in a pure capacitor is known as-

   a) capacitance. b) inductance.

   c) reactance. d) impedance.

---

2. In a pure capacitor the-

   a) voltage is in phase with the current.

   b) current is in phase with the voltage.

   c) current leads the voltage by 90°.

   d) voltage leads the current by 90°.

---

3. The reactance 'X_C' of a capacitor-

   a) remains constant with frequency.

   b) increases with increase in frequency.

   c) decreases with increase in frequency.

   d) none of the above.

---

4. The reactance of a pure capacitor may be found by applying the formula X_C =

   a) $\frac{\omega C}{R}$ b) $\frac{1}{C R}$ c) ωC d) $\frac{1}{\omega C}$

---

5. The current flowing in a reactive circuit is given by-

   a) $\frac{V}{R}$ b) $\frac{V}{X}$ c) $\frac{V}{C}$ d) CV

6. The current flowing in a circuit consisting of pure capacitance only, is given by-

a) $V \omega C$ b) $\dfrac{V}{\omega C}$ c) $\dfrac{f \omega}{C}$ d) $\dfrac{C}{\omega f}$

7. The symbol 'ω' represents the-

a) actual value of reactance.

b) wattless value of the power.

c) angular velocity, and is equal to $2 \pi f$.

d)'Q' factor of the circuit, equal to $1/\omega C R$.

8. What is the reactance of a $1\mu F$ capacitor at a frequency of 800Hz?

a) 19,999 Ω b) 9,999Ω c) 199Ω d) 99Ω

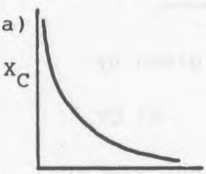
9. What is the reactance of a $1000\mu F$ capacitor at a frequency of 50Hz?

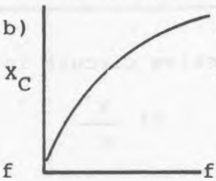
a) 500Ω b) 31·8Ω c) 3·18Ω d) 0·18Ω

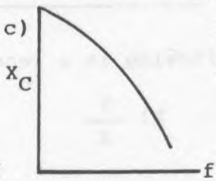
10. What is the reactance or a 10pF capacitor at a frequency of 10MHz?

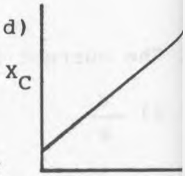
a) 1591kΩ b) 1591Ω c) 1000Ω d) 100Ω

11. The reactance/frequency curve for a capacitor is

a)


b)


c)


d)


2. For the values of capacitance and frequency given below, calculate the reactance.

	C	f	X_C
a)	10μF	1000Hz	________
b)	2μF	796Hz	________
c)	1μF	10,000Hz	________
d)	1000pF	1MHz	________
e)	680pF	10MHz	________
f)	250pF	50MHz	________
g)	100pF	100MHz	________
h)	10pF	150MHz	________
i)	5pF	200MHz	________

---

3. At what frequency will a 2μF capacitor have a reactance of 100Ω?

a) 796kHz b) 796Hz c) 2000Hz d) 200Hz

---

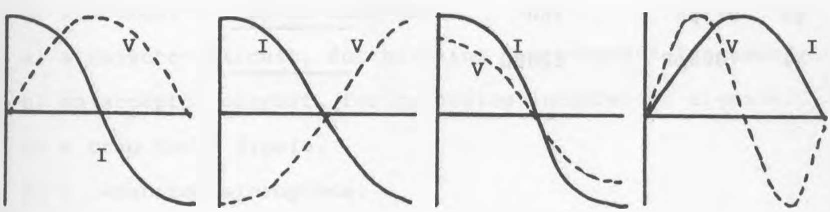
4. A 1000pF capacitor has a reactance of 1000Ω when the applied signal has a frequency of-

a) 159kHz b) 159Hz c) 1000kHz d) 100Hz

---

5. Which one of the waveforms shown below, represents the voltage and current when an alternating voltage is applied across a pure capacitor?

a) b) c) d)



16. For the values of reactance and frequency given below, calculate the capacitance.

	X_C	f	C
a)	1000Ω	10Hz	________
b)	1000Ω	1000Hz	________
c)	25Ω	10,000Hz	________
d)	10Ω	1MHz	________
e)	5Ω	10MHz	________
f)	100Ω	10MHz	________
g)	1000Ω	20MHz	________
h)	2900Ω	20MHz	________
i)	1000Ω	100MHz	________

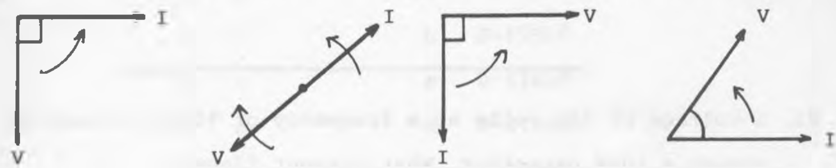
---

17. For the values of capacitance and reactance given below, calculate the frequency.

	C	X_C	f
a)	10μF	100Ω	________
b)	10μF	1000Ω	________
c)	5μF	500Ω	________
d)	2μF	2000Ω	________
e)	1·5μF	6000Ω	________
f)	1μF	1000Ω	________
g)	0·5μF	75Ω	________
h)	1000pF	6280Ω	________

18. Which one of the following vector diagrams is representative of the voltage and current relationships of a pure capacitor?

a) b) c) d)



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19. As the frequency applied to a practical capacitor is increased, the reactance decreases, until a frequency is reached at which the reactance begins to increase. What is the cause of this effect?

a) Self inductance of the capacitor and its wires.

b) Self capacitance of the capacitor and its wires.

c) Frequency distortion within the capacitor.

d) None of the above.

---

20. The leads of a capacitor may be cut to a certain length so that the capacitor becomes-

a) parallel resonant at a certain frequency.

b) super conductive at all frequencies.

c) super inductive at all frequencies.

d) series resonant at a certain frequency.

---

21. When a capacitor is made resonant by adjusting the length of its leads it may be used as-

a) a rejector circuit, for blocking non-resonant frequencies.

b) an acceptor circuit, for bypassing interfering signals.

c) a trap for a dipole.

d) a capacitor microphone.

22. A voltage of 200 volts at a frequency of 50Hz is applied across a 2μF capacitor. What current flows?

a) 500mA b) 250mA c) 125mA d) 100mA

---

23. A voltage of 100 volts at a frequency of 100Hz is applied across a 10μF capacitor. What current flows?

a) 1·0A b) 0·707A c) 0·63A d) 0·141A

---

24. A 0·5μF capacitor has a voltage of 10 volts applied, at a frequency of 5kHz. What current flows?

a) 50mA b) 141mA c) 151mA d).157mA

---

25. The current flowing in a circuit consisting of pure capacitance only, is 1 amp. The applied voltage is 250 volts at a frequency of 100Hz. What is the value of the capacitor?

a) 2·55μF b) 3·22μF c) 6·36μF d) 10μF

---

26. Capacitive reactance is considered-

a) positive, the voltage leads the current by 90°.

b) negative, the voltage lags the current by 90°.

c) neutral, there is no phase change.

d) antiphase, there is a 180°phase change.

5. CAPACITIVE REACTANCE

1	c
2	c
3	c
4	d
5	b
6	a
7	c
8	c
9	c
10	b
11	a
12a	15.9Ω
b	99•97Ω
c	15•9Ω
d	159Ω
e	23•4Ω
f	12•7Ω
g	15•9Ω
h	106•1Ω
i	159Ω
13	b
14	a
15	a

16a	15•9μF
b	0•159μF
c	0•636μF
d	0•0159μF
e	3•183nF
f	159pF
g	7•95pF
h	2•74pF
i	1•59pF
17a	159Hz
b	15•9Hz
c	63•66Hz
d	39•78Hz
e	17•68Hz
f	159Hz
g	4244Hz
h	25•343kHz
18	a
19	a
20	d
21	b
22	c
23	c
24	d
25	c
26	b

6. INDUCTANCE

1. The unit of inductance is the-

   a) Henry. b) Farad. c) Flux. d) Joule.

---

2. A practical inductor consists of a number of turns of wire, either self supporting or wound on a former. The effect of increasing the number of turns on the coil is to-

   a) increase the inductance.

   b) decrease the inductance.

   c) reduce the magnetic field.

   d) reduce the capacitance.

---

3. If an inductor has a length of 10cms, and comprises of 10 turns, the effect of stretching the 10 turns over a length of 20cms will be to-

   a) increase the inductance.

   b) reduce the inductance.

   c) triple the magnetic field.

   d) reduce the inductance to zero.

---

4. When an iron core is inserted in the centre of an inductor, the value of inductance-

   a) increases. b) decreases.

   c) remains the same. d) decreases to zero.

---

5. When a brass core is inserted in the centre of an inductor, the value of inductance-

   a) increases. b) decreases.

   c) remains the same. d) decreases to zero.

6. If the current flowing in an inductor changes at the rate of 1 Amp/second, and the voltage across its terminals is 1V, the value of the inductor is-

a) 1μH   b) 1mH   c) 1H   d) 10H

---

7. When the current flowing in an inductor changes-

a) a back e.m.f. is produced which opposes the change which causes it.

b) a back e.m.f. is produced which aids the change which causes it.

c) the inductance value decreases.

d) the magnetic field collapses.

---

8. When does a 10cm length of copper wire possess the property of inductance?

a) Only when it is wound into a coil.

b) Only when it is silver plated.

c) It is always inductive.

d) It does not.

---

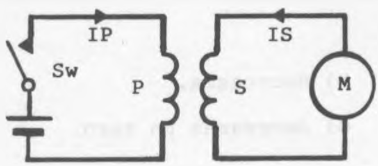
9. 

Fig.1

Fig.1 shows 2 coils in close proximity, so that the magnetic field of coil P cuts the turns of coil S. The indicating device M will deflect when-

a) the current IP has reached its steady state condition.

b) the current IP does not vary.

c) the current IS is zero.

d) there is a current change in coil P.

10. When 2 coils are magnetically coupled, as in fig.1, the e.m.f. induced in coil S, caused by a change of current in coil P, is due to-

a) mutual induction. b) self induction.

c) bi-metalic conduction. d) electrostatic radiation.

11.

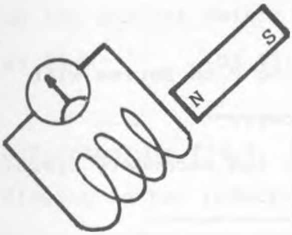


Fig.2

Referring to fig.2. A bar magnet is moved in, and then out of the coil. The meter is a centre zero type. What deflection would you expect the meter to display?

a) Remain at zero as the induced currents oppose eachother.

b) The meter will deflect to the left and return to zero.

c) The meter will deflect to the right and return to zero.

d) The meter will deflect first to one side as the magnet is inserted and return to zero, it will then deflect to the other side as the magnet is withdrawn and return to zero.

12.

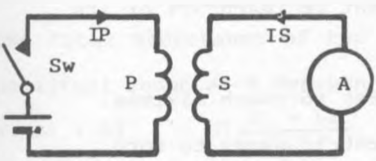


Fig.3

Referring to fig.3. With switch Sw closed, and under steady state conditions, i.e. there is no further current variation in the primary winding P-

a) there will not be a deflection on the meter.

b) the current IS will flow anticlockwise.

c) the current IS will flow clockwise.

d) there will be no current flow in P.

13. Referring to fig.3. With switch 'Sw' closed and under steady state conditions, i.e. there is no further current variation taking place, the d.c. primary current IP will be limited by-

a) the resistance of the meter in the secondary circuit.

b) the resistance of the secondary winding S, in series with the meter resistance.

c) the resistance of the primary winding P in series with the internal resistance of the battery.

d) the joint resistance of the primary and secondary circuits.

---

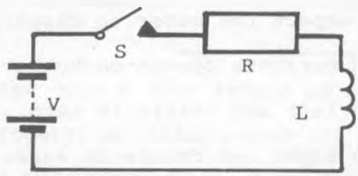
14. 

Fig.4

The time constant 't' for the circuit shown in fig.4 is given by-

a) R/L　　b) R^2/L

c) L^2/R　　d) L/R

---

15. Referring to fig.4. The time constant of the R L circuit may be expressed as-

a) the time taken for the current to reach 63% of its final steady value.

b) the time taken for the current to reach 37% of its final steady value.

c) the time taken for the current to reach maximum.

d) the time taken for the current to decay to zero.

---

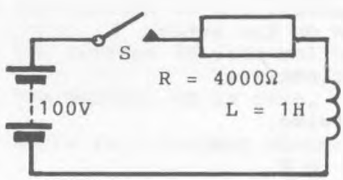
16. 

Fig.5

referring to fig.5. What is the time constant of the circuit?

a) 40s　　b) 4s

c) 0•4ms　　d) 0•25ms

17. Referring to fig.5. If the 4000Ω resistor is replaced by one of 8000Ω. What is the time taken for the current in the inductor to reach 63% of its final steady value?

a) 0·125ms b) 0·25ms c) 0·4ms d) 2·5ms

---

18. Referring to fig.5. What current will flow in the circuit at the instant switch 'S' is closed?

a) 25mA b) 15·75mA c) 9·25mA d) Zero

---

19. Referring to fig.5. What will be the steady state current flowing in the inductor when switch 'S' has been closed for a period of at least 5CR?

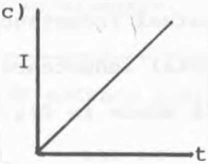
a) 400mA b) 40mA c) 25mA d) 2·5mA

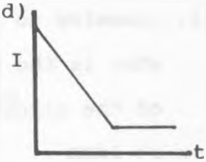
---

20. Referring to fig.5. Which one of the current/time curves shown below is representative of a series R L circuit when switch 'S' is closed?

a) 

b) 

c) 

d) 

---

21. The total inductance of two series connected inductors, with no mutual inductance between them is given by-

a) $L1 + L2$ b) $\frac{L1 + L2}{L1 \times L2}$ c) $\frac{L1 \times L2}{L1 + L2}$ d) $\frac{L1}{L2}$

---

22. The total inductance of the two series connected inductors, shown below, with no mutual inductance between them is-

Fig.6

a) 3·33H b) 15H
c) 50H d) 500H

23. The total inductance of 2 inductors connected in parallel with no mutual inductance between them is given by-

a) L1 + L2   b) $\frac{L1 + L2}{L1 \times L2}$ c) $\frac{L1 \times L2}{L1 + L2}$ d) $\frac{L1}{L2}$

24.

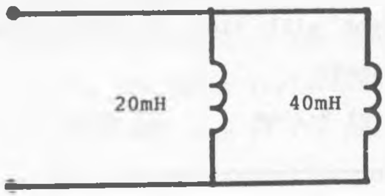


Fig.7

Assuming no mutual inductance, the total inductance of the 2 parallel connected inductors shown in fig.7 is-

a) 1H   b) 800mH

c) 60mH   d) 13·33mH

25.

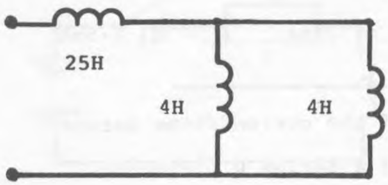


Fig.8

Assuming no mutual inductance, the total inductance of the circuit shown in fig.8 is-

a) 200H   b) 29H

c) 27H   d) 2H

---

26. Assuming no mutual inductance, what is the total inductance of the circuit shown in fig.9?

a) 240H   b) 20H

c) 12H   d) 3·2H

Fig.9

---

27. Two series connected inductors of 5H and 15H respectively, are spaced so that the mutual inductance between them is 4H, as shown in fig.10. What is the resulting inductance when they are connected in series aiding?

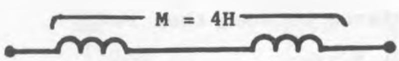


Fig.10 5H 15H

a) 20H   b) 24H

c) 28H   d) 12H

28. The two series connected inductors shown in fig.10 are now connected in series opposing, what is the effective inductance of this combination?

a) 20H b) 24H c) 28H d) 12H

---

29. A reasonable value of inductance for a transmitter power supply smoothing choke would be about-

a) 10-100mH b) 10-30H c) 0•5-1H d) 100-2000H

---

30. The coil used for tuning the RF sections of a VHF receiver would probably consist of-

a) about 4000 turns of thin, silver plated, copper wire.

b) about 100 turns of soft copper wire wound on a bundle of soft iron wires.

c) 1500 turns of very fine wire wound on a 10kΩ non-inductive resistor.

d) 2-8 turns of 18 s.w.g. silver plated copper wire, self-supporting, and about 0•5-1cm in diameter.

---

31. A typical tuning coil used in a HF antenna tuning unit might consist of-

a) about 4000 turns of cotton covered 36 s.w.g. wire.

b) about 100 turns of soft copper wire wound on a bundle of soft iron wires.

c) about 50 turns of 18 s.w.g. silver plated copper wire wound on a 3 inch diameter ceramic former with tapping connections or a geared roller.

d) about 5 turns of 10 s.w.g. aluminium wire, wound on a cardboard former of 5 inch diameter with tapping points every turn.

32. A radio frequency choke (R.F.C.) intended for operation at 100MHz may be constructed in one of the following forms-

a) about 4000 turns of fine wire, silk insulated and wound on a 25 Watt non-inductive resistor.

b) about 5-20 turns of 22 s.w.g. insulated copper wire wound on a ferrite core 2·5cm (1 inch) long.

c) 100 turns of resistance wire, wound on a 5cm diameter glass tube 20cm (8 inches) long.

d) 465 turns of fine insulated multistrand wire, wound on a 6mm nylon former, enclosed in a screening can.

---

33. Two of the factors that contribute to the effective series resistance of a practical coil used at radio frequencies are-

a) construction of the former and insulation of the wire.

b) type of solder used and diameter of the turns.

c) resistivity of the copper used for the wire and the frequency of operation.

d) none of the above.

---

34. At high frequencies, the effective resistance of an inductor increases, this is due to-

a) the reactance of the stray capacity.

b) construction of the former.

c) rigidity of the turns of the coil.

d) skin effect.

35. A transmitting coil is constructed from 18 s.w.g. silver plated copper wire, why is the wire silver plated?

a) To reduce skin infection if the operator is scratched, a requirement of the health and safety at work act.

b) To reflect incoming interference.

c) To make the wire easier to solder.

d) To reduce surface, or skin resistance.

---

36. The term 'skin effect' refers to the way in which-

a) RF currents tend to travel out to the surface of a wire as the frequency increases.

b) the surface skin of a wire oxidises causing decomposition of the coil.

c) infection sets-in when a person is scratched by oxidised copper wire.

d) copper wire resists being soldered.

---

6. INDUCTANCE

1	a	19	c
2	a	20	a
3	b	21	a
4	a	22	b
5	b	23	c
6	c	24	d
7	a	25	c
8	c	26	d
9	d	27	c
10	a	28	d
11	d	29	b
12	a	30	d
13	c	31	c
14	d	32	b
15	a	33	c
16	d	34	d
17	a	35	d
18	d	36	a

7. INDUCTIVE REACTANCE

1. Opposition to current flow in a pure inductor is termed-

   a) inductance. b) resistance.

   c) reactance. d) impedance.

---

2. In a pure inductor, the-

   a) voltage is in phase with the current.

   b) current is in phase with the voltage.

   c) current leads the voltage by 90^o.

   d) voltage leads the current by 90^o.

---

3. The reactance of an inductor-

   a) remains constant with change in frequency.

   b) increases with increase in frequency.

   c) decreases with increase in frequency.

   d) is very high when direct currents are present.

---

4. The reactance of an inductor may be found by applying the formula X_L =

   a) $\omega^2 L$ b) $\frac{1}{\omega L}$

   c) $f^2 L$ d) ωL

---

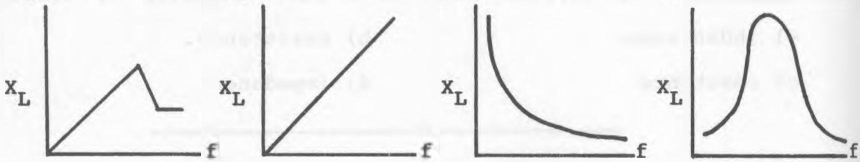
5. The current said to be flowing in a circuit consisting of pure inductance is given by-

   a) $\frac{V}{\omega L}$ b) $\frac{V}{\omega f}$

   c) $\frac{V^2}{\omega L}$ d) ωL

6. Which one of the reactance/frequency characteristics shown below is representative of a pure inductor?

a) b) c) d)



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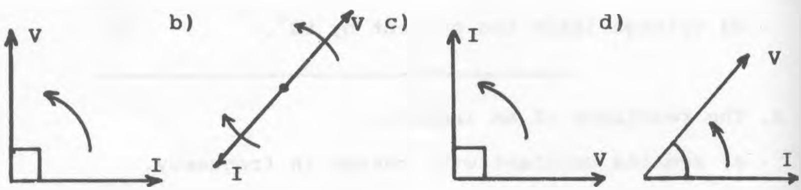
7. Which of the following vector diagrams is representative of a pure inductor?

a) b) c) d)



---

8. What is the reactance of a pure inductor of 10 Henries at a frequency of 50Hz?

a) 3141Ω b) 3·18Ω c) 31·41Ω d) 31·8Ω

---

9. What is the reactance of a 1 Henry inductor at a frequency of 1000Hz?

a) 6283Ω b) 6·36Ω c) 62.82Ω d) 63·6Ω

---

10. A 5mH inductor has a frequency of 5MHz applied, what is the reactance of the inductor?

a) 10kΩ b) 15·7kΩ c) 157·079kΩ d) 125·6kΩ

---

11. What is the reactance of a 1mH inductor, given that ω is equal to 5000 rad/sec?

a) 5Ω b) 50Ω c) 500Ω d) 5000Ω

12. For the values of inductance and frequency given below, calculate the reactance.

	L	f	X_L
a)	10H	1000Hz	________
b)	1H	5kHz	________
c)	0·5H	5kHz	________
d)	200mH	1MHz	________
e)	200mH	100Hz	________
f)	100mH	50Hz	________
g)	1mH	10MHz	________
h)	1μH	100MHz	________
i)	1μH	150MHz	________

13. For the values of inductance and reactance given below, calculate the frequency.

	L	X_L	f
a)	10H	100 Ω	________
b)	2H	1000 Ω	________
c)	0·1H	1000 Ω	________
d)	0·01H	2500 Ω	________
e)	1000μH	100 Ω	________
f)	318μH	1000 Ω	________
g)	200μH	1000 Ω	________

14. For the values of reactance and frequency given below, calculate the inductance.

	X_L	f	L
a)	400Ω	100kHz	________
b)	20kΩ	1MHz	________
c)	10kΩ	5MHz	________
d)	1000Ω	5kHz	________
e)	250Ω	5000Hz	________
f)	100Ω	30MHz	________
g)	50Ω	100MHz	________

---

15. A practical inductor becomes parallel resonant at a certain frequency, this is due to-

a) the self inductance of low grade copper wire.

b) the self capacitance between the turns of the coil.

c) the impurities in the coil former.

d) the value of the applied voltage.

---

16. What would be the value of current flowing in an inductor of 20mH, if connected across a supply of 70·7 volts at a frequency of 796Hz?

a) 0·707A   b) 7·07A   c) 70·7A   d) 796mA

---

17. A 100mH inductor has 10 volts applied across it at a frequency of 1000Hz. What current flows?

a) 100mA   b) 15·9mA   c) 159mA   d) 1000mA

7. INDUCTIVE REACTANCE

1	c
2	d
3	b
4	d
5	a
6	b
7	a
8	a
9	a
10	c
11	a
12a	62·8kΩ
b	31.4kΩ
c	15·7kΩ
d	1256kΩ
e	125·6Ω
f	31·4Ω
g	62·8kΩ
h	628·3Ω
i	942·5Ω
13a	1·59Hz
b	79·6Hz
c	1591·5Hz
d	39·79kHz
e	15·9kHz
f	500·49kHz
g	795·8kHz
14a	0·63mH
b	3·18mH
c	0·318mH
d	31·8mH
e	7·96mH
f	0·53μH
g	0·079μH
15	b
16	a
17	b

8. IMPEDANCE

> Note. Remember that $X_L = \omega L = 2\pi fL$
> and that $X_C = \dfrac{1}{\omega C} = \dfrac{1}{2\pi fC}$

1. The opposition to current flow in a circuit consisting of resistance and reactance is called-

   a) reactance. b) impedance.

   c) resonance. d) reluctance.

---

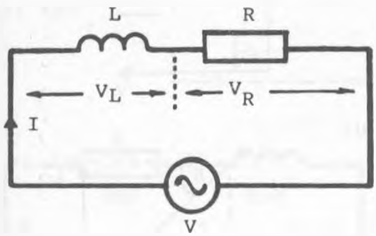
2. 

Fig.1

Referring to fig.1. The current I, flowing in R is-

   a) in phase with V_R.

   b) leading V_R by 90^o.

   c) lagging V_R by 90^o.

   d) 180^o out of phase with V_R.

---

3. The voltage, V_L, across the inductor shown in fig.1-

   a) leads I by 90^o. b) lags I by 90^o.

   c) is in phase with I. d) is 180^o out of phase with I.

---

4. The voltage, V_L, across the inductor in fig.1, is given by-

   a) $I \omega L$ b) $L / \omega L$ c) $\omega^2 L^2 I$ d) $2 \pi \omega L$

---

5. The applied voltage V, in fig.1, is given by-

   a) the vector division of V_R and V_L.

   b) the vector product of V_R and V_L.

   c) the vector sum of V_R and V_L.

   d) the product of I and V_L.

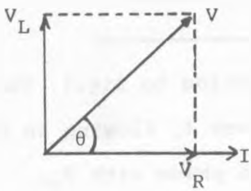
6. What is the formula for the impedance of the series circuit shown in fig.1?

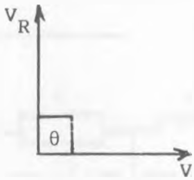
a) $Z = \sqrt{R^2 + X_L^2}$ b) $Z = R + X_L$

c) $Z = R^2 + X^2$ d) $Z = R^2 + X_L^2$

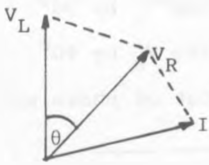
7. Which of the vector diagrams shown below is representative of the circuit shown in fig.1?

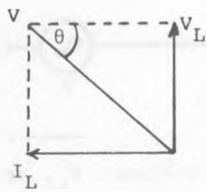
a) b)





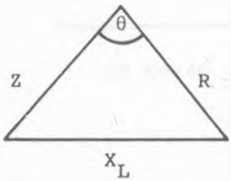
c) d)

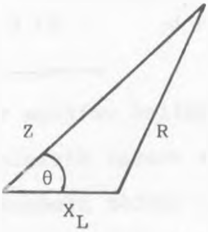




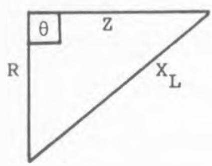
8. From the vector diagram, an 'impedance triangle' can be constructed this would take the form-

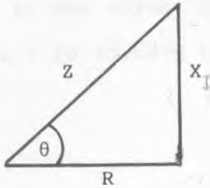
a) b)





c) d)





9. From whose formula for right-angled triangles was the general formula for impedance developed?

(See also Q6 and 8).

a) Taurus. b) Sir Henry Wood.

c) Sagittarius. d) Pythagoras.

---

10. The phase angle of the circuit shown in fig.1 is given by the formula-

a) $\tan^{-1}\frac{X_L}{R}$ b) $\tan^{-1} R \times L$

c) $\tan^{-1}\frac{X R}{L}$ d) $\sin^{-1}\frac{\sin X_L}{\tan R}$

11.

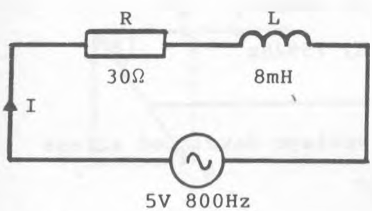


Fig.2

What is the impedance Z, of the circuit shown in fig.2?

a) 240Ω

b) 0•24Ω

c) 50Ω

d) 800Ω

---

12. What is the current, I, flowing in the circuit of fig.2?

a) 20•8mA b) 20•8A c) 0•1A d) 6•25mA

---

13. What is the phase angle of the circuit shown in fig.2?

a) $53{\cdot}13^{0}$ b) $27{\cdot}3125^{0}$ c) 90^{0} d) $27{\cdot}575^{0}$

---

14. Referring to Q 13. The phase angle you chose indicates that-

a) the applied voltage leads the current by $53{\cdot}27^{0}$

b) the applied voltage leads the current by $27{\cdot}3125^{0}$.

c) the current flowing in the circuit leads V by 90^{0}.

d) the current flowing in the circuit leads V by $27{\cdot}575^{0}$.

15 Referring to fig.2. What is the voltage V_R developed across the 30Ω resistor?

a) 5V b) 4V c) 3V d) 2V

---

16. Referring to fig.2. What is the voltage V_L developed across the 8mH inductor?

a) 5V b) 4V c) 3V d) 2V

17.

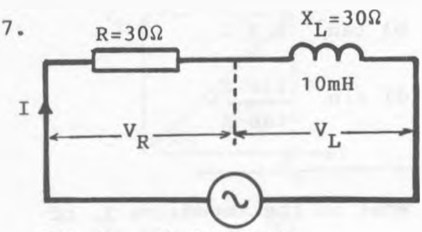


Fig.3 V Applied.

Referring to fig.3. What is the supply frequency?

a) 477Hz

b) 796Hz

c) 954Hz

d) 1592Hz

---

18. Referring to fig.3. What is the voltage developed across the 10mH inductor, when I = 1Amp?

a) 3V b) 30V c) 90V d) 900V

---

19. Referring to Q17&18. The voltage applied to the circuit is-

a) 30V b) 40V c) 42·4V d) 90V

20.

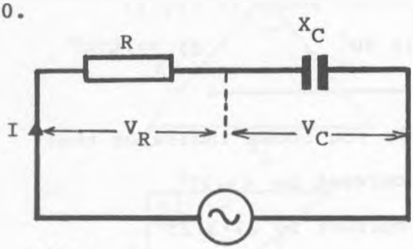


Fig.4

The impedance of the series R C circuit shown in fig.4, is given by-

a) $Z = \sqrt{R^2 + X_C^2}$

b) $Z = R + X_C$

c) $Z = R^2 + X_C^2$

d) $Z = \sqrt{R + Z_C^2}$

21. The phase angle of the R C circuit shown in fig.4 is given by

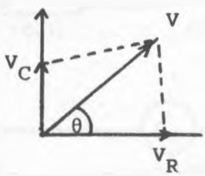
a) $\tan^{-1} \dfrac{1}{\omega C R}$ b) $\tan^{-1} \dfrac{\pi}{\omega C}$

c) $\tan^{-1} R X C$ d) $\sin^{-1} \dfrac{\omega}{\sin\omega}$

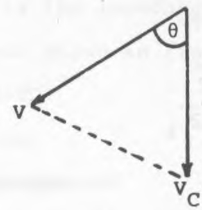
---

22. Which one of the vector diagrams shown below is representative of the circuit shown in fig.4?

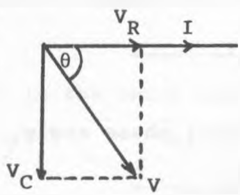
a)



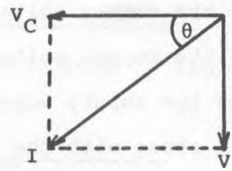
b)



c)



d)



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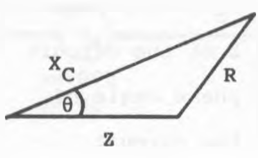
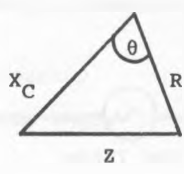
23. From the vector diagram chosen in Q 22 above, an impedance triangle may be constructed. Which of the triangles shown below is the impedance triangle for the series R C circuit?

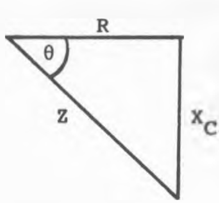
a)



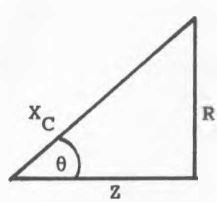
b)



c)



d)



24. The voltage across the capacitor, V_C in fig.4-

a) lags the current by 90^o.

b) leads the current by 90^o.

c) is in phase with the current.

d) is 180^oout of phase with the current.

---

25. The voltage across the capacitor in a series R C circuit is given by-

a) $\dfrac{I}{\omega C}$ b) $I \omega C$

c) $\omega^2 C^2 L$ d) $2 \omega C$

---

26. Referring to fig.4. In the R C circuit the supply current I-

a) lags the supply voltage by 90^o.

b) lags the supply voltage by 180^o.

c) leads the supply voltage by the circuit phase angle.

d) is in phase with the supply voltage.

27.

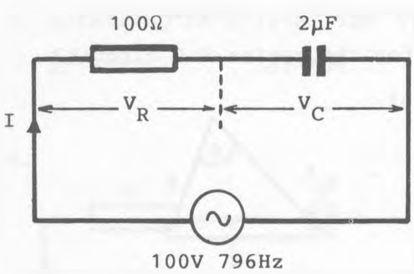


Fig.5

From the information given in fig.5, calculate the following-

a) X_C of the capacitor ______

b) Z of the circuit ______

c) phase angle of the circuit ______

d) supply current ______

e) V_R ______

f) V_C ______

28. When a circuit consists of L, C and R, the total impedance of the circuit can be calculated from the formula-

a) $Z = \sqrt{R^2 + (X_L - X_C)^2}$

b) $Z = R^2 + X^2 + L^3$

c) $Z = R^2 + (X_C - X_L)^2$

d) $Z = \sqrt{R^2 + X_L + X_C}$

29.

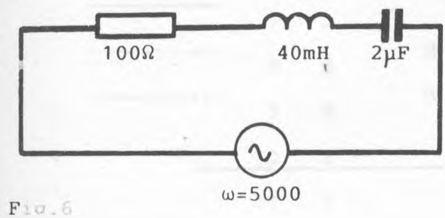


Fig.6

What is the impedance of the circuit shown in fig.6?

a) 70·7Ω

b) 100Ω

c) 141·4Ω

d) 200Ω

---

30. What is the phase angle of the circuit shown in fig.6?

a) 45^0 b) -45^0 c) 180^0 d) 360^0

31.

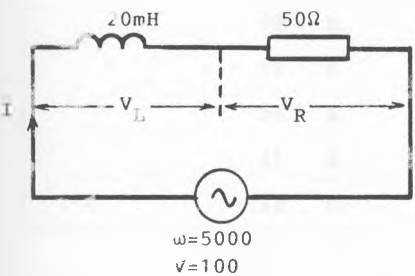


Fig.7

Referring to the circuit shown in fig.7, calculate the following-

a) X_L ____________

b) Z ____________

c) frequency ____________

d) phase angle ____________

e) I ____________

f) V_R ____________

g) V_L ____________

32.

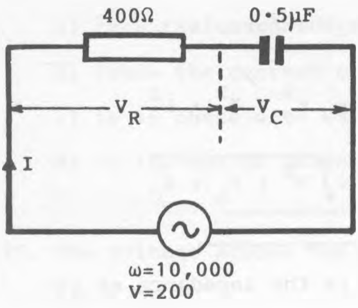


Fig.8

Referring to the circuit shown in fig.8, calculate the following-

a) X_C __________

b) Z __________

c) frequency __________

d) phase angle __________

e) I __________

f) V_R __________

g) V_C __________

8. IMPEDANCE

1	b
2	a
3	a
4	a
5	c
6	a
7	a
8	d
9	d
10	a
11	c
12	c
13	a
14	a
15	c
16	b
17	a
18	b
19	c
20	a
21	a
22	c
23	c
24	a
25	a
26	c

27a	100Ω
b	141·4Ω
c	-45^0
d	0·707A
e	70·7V
f	70·7V
28	a
29	c
30	a
31a	100Ω
b	111·8Ω
c	796Hz
d	$+63{\cdot}4^0$
e	0·894A
f	44·7V
g	89·4V
32a	200Ω
b	447·2Ω
c	1592Hz
d	$-26{\cdot}5^0$
e	0·447A
f	178·8V
g	89·4V

9. RESONANCE

1. The condition of resonance occurs when-

   a) the resistance and the reactance cancel.

   b) the resistance and the reactance add.

   c) the inductive reactance is equal to the capacitive reactance and opposite in sign.

   d) the losses in the circuit are confined to the inductor.

---

2. Fig.1 shows a series L C circuit, the resonant frequency can be found by applying the formula-

Fig.1

a) $\dfrac{3 \times 10^8}{2 \pi L}$

b) $\dfrac{(300 \times 10^6) f}{2 \pi C L}$

c) $\dfrac{1}{4 \pi L}$

d) $\dfrac{1}{2\pi \sqrt{L C}}$

---

3. What happens to the resonant frequency when the value of the capacitor is decreased?

   a) It remains the same.
   b) It decreases.
   c) It increases.
   d) It becomes super resonant.

---

4. If the value of the inductor in a series resonant circuit is increased, the resonant frequency-

   a) remains the same.
   b) decreases.
   c) increases.
   d) damps to 0Hz.

5. Resonance occurs when-

a) $X_L = X_C$ b) $L\ R = C^2$

c) $X_L = X^2\ L^2\ C^2$ d) $X_C = f_r^{\ 2}$

---

6. The resistance 'R' in the series circuit shown in fig.2 will-

Fig.2

a) decrease the resonant frequency.

b) increase the resonant frequency.

c) have no effect on the resonant frequency.

d) cancel with X_L at resonance.

---

7. At resonance, the impedance of the series circuit of fig.2, is equal to-

a) the reactance of the inductor.

b) the reactance of the capacitor.

c) the series resistance 'R'.

d) $X_C + X_L + R^2$.

8.

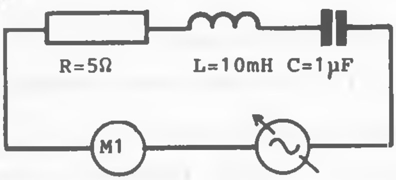


Fig.3

At resonance, the impedance of the series circuit shown in fig.3 is-

a) 500Ω b) 50Ω

c) 5Ω d) 0·5Ω

---

9. What is the resonant frequency of the circuit shown in fig.3?

a) 500Hz b) 796Hz c) 1592Hz d) 15·92kHz

10. What is the resonant frequency of the circuit shown in fig.3 when the capacitor is changed to 4μF?

a) 500Hz   b) 796Hz   c) 1592Hz   d) 1·592kHz

---

11. The value of the capacitor shown in fig.3 is changed to 4μF. What is the circuit impedance at resonance?

a) 500Ω   b) 200Ω   c) 50Ω   d) 5Ω

---

12. Referring to fig.3. If the a.c. supply voltage is 20 volts and is at the resonant frequency of the circuit, what current will flow in the 5Ω resistor?

a) 40A   b) 20A   c) 10A   d) 4A

---

13. Referring to fig.3. Increasing the value of 'R' to 10Ω will-

a) increase the resonant frequency.

b) decrease the resonant frequency.

c) increase the current flowing in the circuit at resonance.

d) decrease the current flowing in the circuit at resonance.

---

14. Referring to fig.3. Reversing the connections to the coil shown in the circuit will-

a) increase the resonant frequency.

b) decrease the resonant frequency.

c) not change the resonant frequency.

d) stop all current flow at resonance.

---

15. The variable signal source shown in fig.3 is slowly swept through the resonant frequency of the tuned circuit. What will ammeter M1 indicate as the resonant frequency is passed?

a) Nothing.   b) A dip   c) A peak   d) 6·284A

16. In a series L C R circuit, the current at resonance is-

a) maximum b) minimum c) zero d) 3.142A

---

17. The resonant frequency of the circuit shown in fig.4 is 1592Hz. What is the current at resonance?

a) 50A b) 5A

c) 2A d) 1A

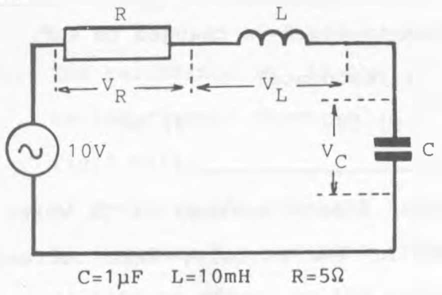


Fig.4

---

18. Referring to fig.4. What is the voltage V_R at the resonant frequency?

a) 100V b) 10V c) 5V d) 1V

---

19. Referring to fig.4. What is the voltage V_L developed across the coil at the resonant frequency?

a) 10mV b) 10V c) 20V d) 200V

---

20. Referring to fig.4. What is the voltage V_C developed across the capacitor at the resonant frequency?

a) 5V b) 10V c) 200V d) 1000V

---

21. The high voltages developed across the coil and the capacitor shown in fig.4, are due to the-

a) resistance of those particular components.

b) temperature of those particular components.

c) voltage ratings of those particular components.

d) 'Q' or magnification factor of those particular components.

22. The 'Q' factor of the inductor shown in fig.4 is-

a) 1 b) 5 c) 10 d) 20

---

23. Referring to fig.4. At resonance, the voltages across the inductor V_L, and the capacitor V_C,-

a) cancel. b) add. c) multiply. d) square.

---

24. Referring to fig.4. If the value of 'R' is halved, the voltages V_L and V_C will-

a) halve. b) double.

c) remain the same. d) decrease slightly.

---

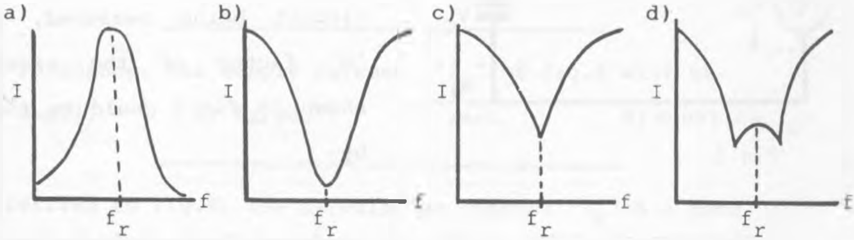
25. If you construct the circuit shown in fig.4 as a practical circuit, would a 16 volts-working capacitor be O.K?

a) Yes. b) No.

c) Only just. d) Yes, if it is a tantalum.

---

26. Which one of the diagrams shown below represent the current/frequency response of a series tuned circuit?



---

27. What is the current/voltage phase relationship across the resistor shown in fig.4?

a) I and V are in phase. b) I and V are in anti-phase.

c) I leads V by 90°. d) V leads I by 90°.

28. What is the relationship between the voltages that appear across the two reactive components X_L and X_C, in fig.4?

a) They are equal and in phase.

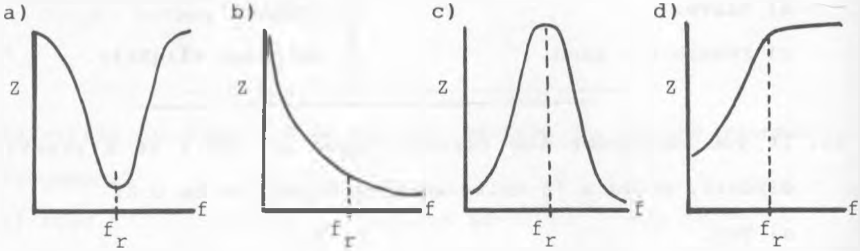
b) They are equal and in anti-phase.

c) They are not equal, but are in phase.

d) They are not equal and are 45° out of phase.

---

29. Which diagram shown below represents the impedance/frequency characteristic of a series tuned circuit?



30.

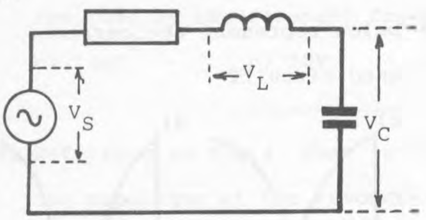


Fig.5

Using a high impedance voltmeter with a suitable frequency response for the circuit being measured, the 'Q' factor of the circuit shown in fig.5 could be found by-

a) measurement of V_S and V_C and applying the formula V_C/V_S.

b) measurement of V_S and V_C and applying the formula V_S/V_C.

c) measurement of V_L and V_C and applying the formula V_L-V_C.

d) measurement of V_L and V_C and applying the formula $V_L \times V_C$.

31. The series resonant circuit is often referred to as-

a) a deflector circuit. b) a rejector circuit.

c) an acceptor circuit. d) a low pass filter.

---

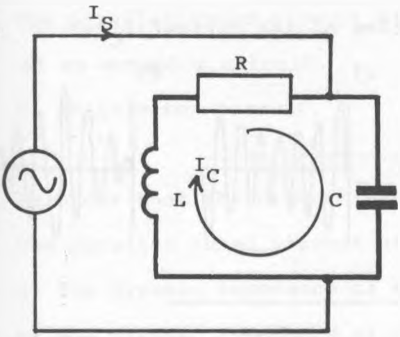
32. 

Fig.6

Fig.6 shows a parallel tuned circuit, the formula for its resonant frequency is the same as for the series circuit so long as the losses are not too great. The impedance at resonance is-

a) low. b) high.

c) zero. d) equal to 'R'

---

33. The dynamic impedance 'Z_D', of a parallel tuned circuit is given by-

a) $\frac{CR}{L}$ b) $\frac{L}{CR}$ c) $\frac{L}{2CR}$ d) $\frac{C}{\omega R}$

---

34. At resonance, the supply current, 'I_S' of fig.6 will be-

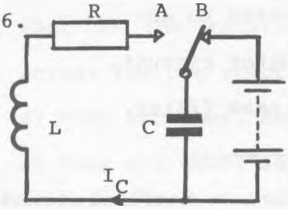
a) small. b) large. c) zero. d) equal to I_C.

---

35. Referring to fig.6. The circulating current 'I_C' in a good quality circuit will be-

a) greater than I_S. b) less than I_S.

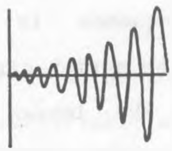
c) equal to I_S. d) zero.

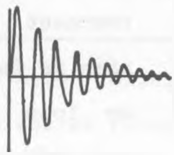
36. 

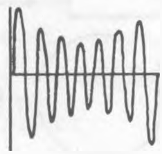
When the capacitor of fig.7 has been charged, switch position B, the switch is thrown to position A.

Which waveform shown below is representative of the current I_C?

Fig.7

a) 

b) 

c) 

d) 

---

37. The damped oscillations that occur in the circuit of fig.7 will decay more rapidly if-

a) the capacitor has a silver mica dielectric.

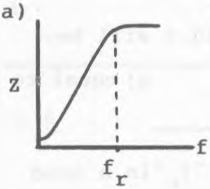
b) the inductor is wound on a glass former.

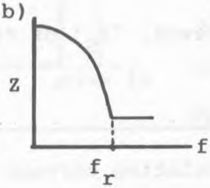
c) the series resistance 'R' is increased.

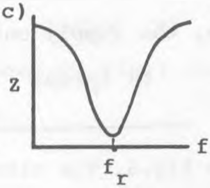
d) the series resistance 'R' is decreased.

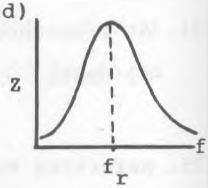
---

38. Which one of the frequency response curves shown below is that of a parallel tuned circuit?

a) 

b) 

c) 

d) 

---

39. The main losses in a high quality parallel resonant tuned circuit, are due to-

a) the permitivity of free space surrounding the coil.

b) the quality of the dielectric material.

c) the 'Q' factor of the capacitor.

d) the copper loss of the coil.

40. The parallel tuned circuit is often referred to as a-

a) gun circuit. b) tank circuit.

c) bandpass filter. d) bypass circuit.

---

41. The parallel tuned circuit might also be referred to as-

a) an acceptor circuit. b) a rejector circuit.

c) an injector circuit. d) a deflector circuit.

---

42. In order that the highest possible voltage is developed across the parallel tuned circuit at the resonant frequency,-

a) the dynamic impedance of the circuit must be high.

b) the dynamic impedance of the circuit must be low.

c) the dynamic impedance of the circuit must be zero.

d) the capacitor must have more loss than the inductor.

---

43. The impedance/frequency response of a tuned circuit is dependent upon the-

a) short-circuiting effect of the capacitor.

b) L/C ratio, and the circuit losses.

c) generator supply voltage.

d) phase of the standard frequency transmissions.

---

44. The 'Q factor' of a capacitor or an inductor is the-

a) Quality factor, or magnification factor.

b) sharpness, or amplification factor.

c) response or dynamic factor.

d) none of the above.

45.

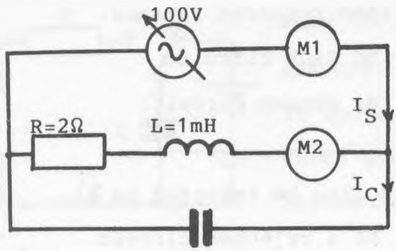


Fig.8 C=1µF

What is the resonant frequency of the circuit shown in fig.8?

a) 503·3kHz

b) 50·33kHz

c) 5033Hz

d) 503·3Hz

---

46. What is the dynamic impedance 'Z_D' of the circuit shown in fig.8?

a) 10Ω b) 100Ω c) 500Ω d) 5000Ω

---

47. Referring to fig.8. What is the supply current 'I_S' at the resonant frequency?

a) 0·2A b) 0·5A c) 1A d) 5A

---

48. The power is supplied to the circuit of fig.8 from a variable frequency generator. If the generator is swept through the resonant frequency of the tuned circuit, the ammeter M1 will-

a) peak at resonance. b) dip at resonance.

c) zero at resonance. d) oscillate at resonance.

---

49. Referring to fig.8. When the variable frequency generator is swept through the resonant point of the circuit, ammeter M2 will-

a) peak. b) dip.

c) go to zero. d) oscillate.

---

50. The 'Q factor' of the circuit of fig.8 may be derived from measurement of I_S and I_C, and applying the formula-

a) $Q = I_S \times I_C$ b) $Q = I_S + I_C$

c) $Q = I_S/I_C$ d) $Q = I_C/I_S$

51. The response curve of an L C circuit is plotted and shown in fig.9. What is the 'Q' of the circuit?

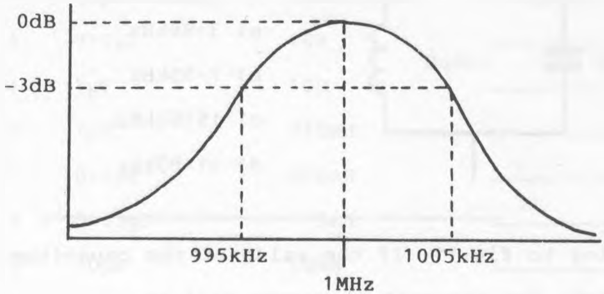


Fig.9

a) 5   b) 50   c) 100   d) 500

---

52. A circuit consisting of inductance and capacitance in series has a 'Q' of 100, and a resonant frequency of 10MHz. What is the bandwidth of the circuit at the half power, or -3dB points?

a) 100kHz   b) 707kHz   c) 1000kHz   d) 10MHz

---

53. The effect of increasing the resistive losses in a tuned circuit will-

a) decrease the bandwidth.

b) increase the bandwidth.

c) notch the frequency response curve.

d) cause regenerative feedback.

54.

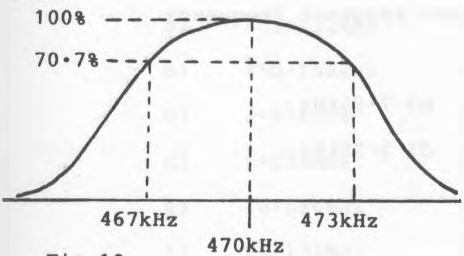


Fig.10

What is the 'Q factor' of the circuit that produced the response curve shown in fig.10?

a) 78·33   b) 47

c) 470   d) 0·012

55.

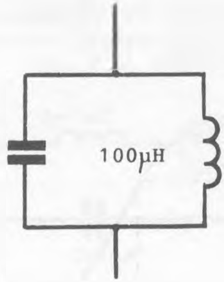


Fig.11

What is the resonant frequency of the circuit shown in fig.11?

a) 3·98kHz

b) 7·95kHz

c) 15·92kHz

d) 31·83kHz

---

56. Referring to fig.11. If the value of the capacitor is reduced to 0.25μF, the resonant frequency will be-

a) doubled.

b) halved.

c) squared.

d) quartered.

---

57. Referring to question 56, the new resonant frequency will be-

a) 31·83kHz
b) 7.95kHz
c) 63.66kHz
d) 3.98kHz

---

58. Referring to fig.11. If the value of the inductor is increased by a factor of 4, to 400μH, the resonant frequency will be-

a) doubled.
b) halved.
c) squared.
d) quartered.

---

59. Referring to question 58, the new resonant frequency will be-

a) 31·83kHz
b) 7·95kHz
c) 63·66kHz
d) 3·98kHz

60. Given the inductance L, and the capacitance C, calculate the resonant frequency f_r.

	Capacitance	Inductance	Frequency
a)	3·5μF	10H	________
b)	1μF	10H	________
c)	1μF	750mH	________
d)	0·5μF	250mH	________
e)	0·15μF	175mH	________
f)	10μF	10mH	________
g)	5μF	20mH	________

---

61. Given the resonant frequency f_r, and the inductance L, calculate the Capacitance C.

	Frequency	Inductance	Capacitance
a)	503·3Hz	100mH	________
b)	251·64Hz	200mH	________
c)	71·18Hz	500mH	________
d)	56·27Hz	2H	________
e)	50·329MHz	1μH	________
f)	100·658MHz	0·5μH	________
g)	11·254MHz	10μH	________

---

62. Given the resonant frequency f_r, and the capacitance C, calculate the inductance L.

	Frequency	Capacitance	Inductance
a)	503·292kHz	100pF	________
b)	450·158kHz	50pF	________
c)	2·516MHz	20pF	________
d)	5·033MHz	10pF	________
e)	10·066MHz	5pF	________
f)	20·132MHz	2·5pF	________
g)	28·471MHz	2·5pF	________

9. RESONANCE

1	c	31	c	60a	26·9Hz
2	d	32	b	b	50·33Hz
3	c	33	b	c	183·7Hz
4	b	34	a	d	450·16Hz
5	a	35	a	e	982·325Hz
6	c	36	b	f	503·3Hz
7	c	37	c	g	503·3Hz
8	c	38	d	61a	1μF
9	c	39	d	b	2μF
10	b	40	b	c	10μF
11	d	41	b	d	4μF
12	d	42	a	e	10pF
13	d	43	b	f	5pF
14	c	44	a	g	20pF
15	c	45	c	62a	1mH
16	a	46	c	b	2·5mH
17	c	47	a	c	200μH
18	b	48	b	d	100μH
19	d	49	a	e	50μH
20	c	50	d	f	25μH
21	d	51	c	g	12·5μH
22	d	52	a		
23	a	53	b		
24	b	54	a		
25	b	55	c		
26	a	56	a		
27	a	57	a		
28	b	58	b		
29	a	59	b		
30	a				

10. SEMICONDUCTORS

1. The two main types of pure material used in the construction of semiconductors are-
   a) berylium oxide and aluminium.
   b) gallium arsenide and copper.
   c) strontium and barium.
   d) silicon and germanium.

2. The semiconductor materials are manufactured by taking the pure materials described in Q 1 above and-
   a) mixing them with lead oxide at very high pressure.
   b) doping them with impurity elements.
   c) magnetising them to a high flux density.
   d) removing all their electrons.

3. N-type material-
   a) has a high potential across its faces.
   b) exhibits piezo electric properties.
   c) has an excess of electrons.
   d) has an excess of holes.

4. P-type material-
   a) has a high positive potential across its faces.
   b) exhibits piezo electric properties.
   c) has an excess of electrons.
   d) has an excess of holes.

5. When a junction of P-type and N-type material is formed, a region virtually depleted of all charge carriers exists, this region is referred to as the-

a) depletion layer.

b) neutral junction.

c) carrier barrier.

c) contact junction.

---

6. The device that is formed by the P-N junction shown with its circuit symbol in fig.1 is a-

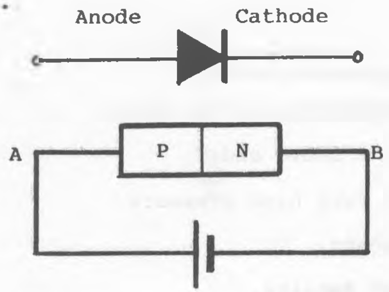


Fig.1

a) triac.

b) diac.

c) diode.

d) triode.

---

7. The device shown in fig.1 is said to be-

a) forward biased.

b) reverse biased.

c) rejecting.

d) accepting.

---

8. The direction of conventional current flow in fig.1 is from-

a) A - B

b) B - A

c) either direction, dependant on battery voltage.

d) A - B or B - A, this is a bi-directional device.

---

9. The principle use of the junction diode is-

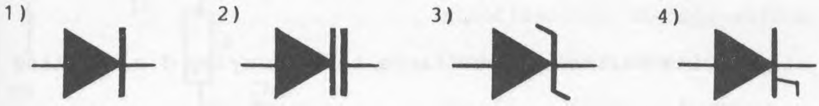
a) oscillatory control circuits.

b) power feedback and amplification circuits.

c) RF filter and harmonic suppression circuits.

d) power rectification, signal mixing and detection.

10. Select the correct order for the four devices shown below.



JD = Junction diode. VC = Vari-cap or varactor diode.

ZD = Zener diode. Th = Thyristor.

a)		b)		c)		d)	
1	JD	1	JD	1	JD	1	Th
2	VC	2	VC	2	Th	2	VC
3	ZD	3	Th	3	ZD	3	ZD
4	Th	4	ZD	4	VC	4	JD

11. The junction diode-

a) is bi-directional.

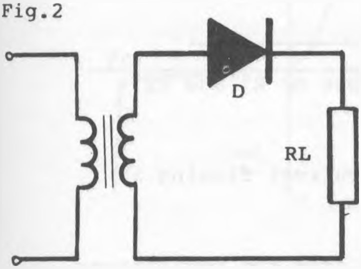
b) does not dissipate heat.

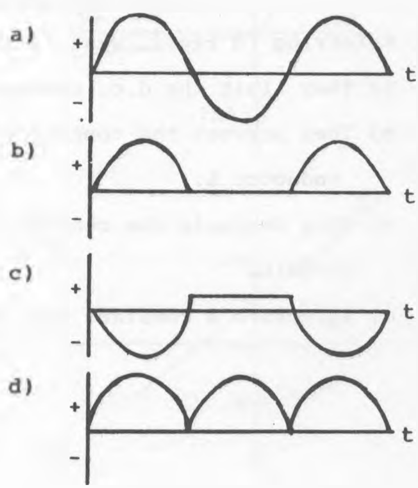
c) amplifies small d.c. signals.

d) passes current in one direction only.

12. The voltage waveform across the load resistor RL fig.2 will be-

Fig.2





13. The varactor (or variable capacitance) diode, is a device that-

a) exhibits variable capacitance for a varying d.c. applied control voltage.

b) is normally used in voltage regulator circuits.

c) is normally used to stabilise oscillator supply current.

d) is tri-directional and used in control circuits.

---

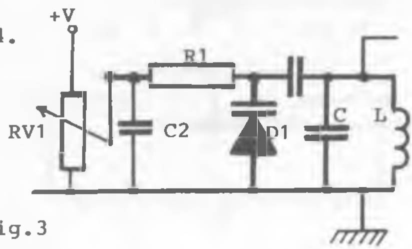
14. 

Fig.3

Fig.3 shows a circuit which employs a varactor diode. What is the function of the varactor diode in this circuit?

a) It stabilises the d.c. voltage.

b) It reduces harmonics of the carrier frequency.

c) It damps the natural resonance of the L C circuit.

d) It enables the resonant frequency of L and C to be tuned by varying RV1.

---

15. Referring to fig.3, what is the purpose of R1 and C2?

a) They limit the d.c. current in D1.

b) They prevent the control circuit current flowing in inductor L.

c) They decouple the control circuit from the oscillatory circuit.

d) To ensure a constant d.c. supply at the diode.

16.

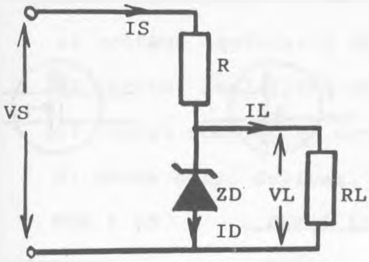


Fig.4 shows a zener diode stabilisation circuit, the current IS is equal to-

a) IL - ID

b) IL + ID

c) ID - IL

d) IS + IL + ID

Fig.4

17. The circuit shown in fig.4 above is used to-

a) maintain a constant VL if VS and RL vary.

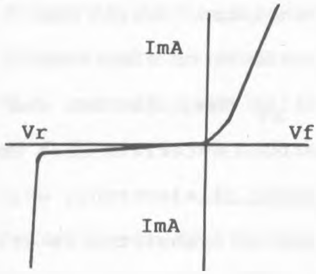
b) prevent parasitic oscillations in power supplies.

c) act as a 'bleeder' to discharge all capacitors in the circuit.

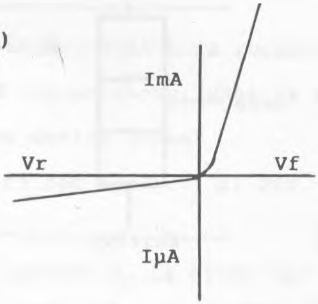
d) prevent the power supply overheating.

18. Which of the curves shown below is characteristic of the zener diode?

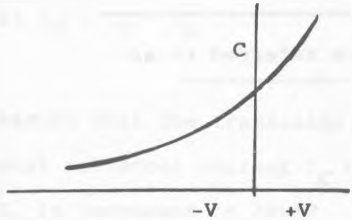
a)



b)



c)



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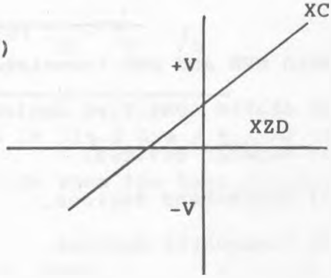
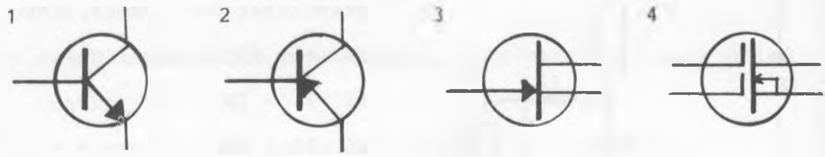


19. Select the correct order for the four devices shown below.



a) 1 PNP
2 NPN
3 JUGFET
4 MOSFET

b) 1 NPN
2 PNP
3 JUGFET
4 MOSFET

c) 1 NPN
2 PNP
3 MOSFET
4 JUGFET

d) 1 NPN
2 JUGFET
3 MOSFET
4 PNP

---

20. Which two of the four transistors shown above have the highest input resistance?

a) NPN - PNP

b) JUGFET - MOSFET

c) PNP - MOSFET

d) JUGFET - NPN

21.

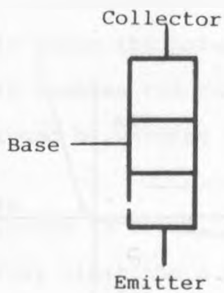


Fig.5

The semiconductor material used for the base of the transistor 'fig.5' has a deficit of electrons, whilst the collector and emitter materials have an excess of electrons, what type of transistor is it?

a) NPN

b) PNP

c) GDS

d) EBC

---

22. Both NPN and PNP transistors are referred to as-

a) static sensitive devices.

b) bipolar devices.

c) anode-bend devices.

d) bimagnetic devices.

23. NPN and PNP bipolar transistors are basically-

a) voltage amplifying devices.

b) current amplifying devices.

c) charge completion devices.

d) phase shift devices.

---

24. The d.c. current gain h_{FE} or β of the transistor shown in fig.6 is given by-

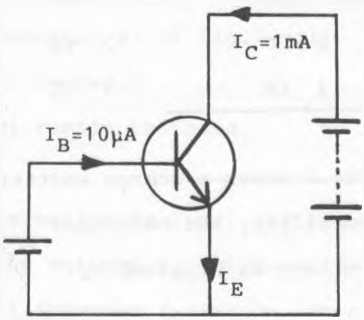


Fig.6

a) $h_{FE} = \frac{I_C}{I_B}$

b) $h_{FE} = \frac{I_B}{I_C}$

c) $h_{FE} = I_B \times I_C$

d) $h_{FE} = I_C - I_E$

---

25. Referring to fig.6, the emitter-base junction is forward biased and the currents measured are as shown, what is the d.c. current gain h_{FE} or β of the device shown?

a) 0·98 b) 49 c) 100 d) 200

---

26. Referring to fig.6, the emitter current I_E is given by-

a) $I_E = I_E - I_B$ b) $I_E = I_B - I_C$

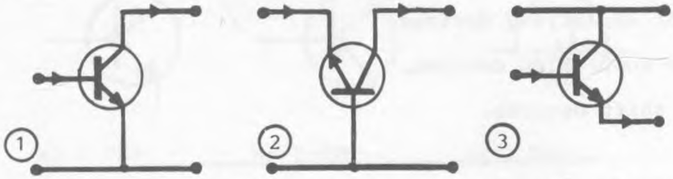
c) $I_E = I_C + I_B$ d) $I_E = I_C - I_B$

---

27. Assume that the transistor shown in fig.6 has a h_{FE} of 100, what collector current I_C will flow when the base current I_B is increased to 20µA?

a) 1·96mA b) 2mA c) 98mA d) 200mA

28. Select the correct order for the three types of transistor configuration shown below-



CE = Common emitter   CB = Common base   CC = Common collector

a)		b)		c)		d)	
1	CE	1	CC	1	CB	1	CE
2	CC	2	CE	2	CC	2	CB
3	CB	3	CB	3	CE	3	CC

29.

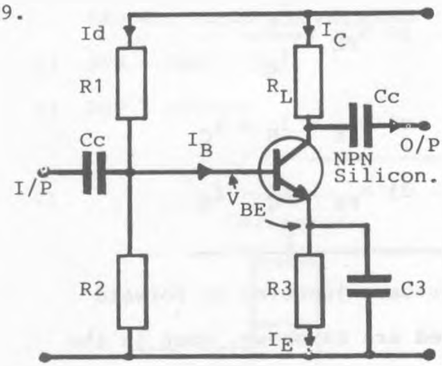


Fig.7

Fig.7 shows a common emitter amplifier, the base bias voltage is obtained by-

a) the potential developed across R_L

b) R_L in conjunction with R1.

c) the potential divider R1,R2.

d) the collector voltage of the previous stage.

---

30. Referring to fig.7, and assuming a silicon transistor, the voltage measured between base and emitter (V_{BE}) would be about-

a) 0•2V   b) 0•7V   c) 2•2V   d) 10V

---

31. If the transistor 'fig.7' is changed for a germanium PNP type, and the supply polarity reversed, what voltage would you expect to measure across the base - emitter (V_{BE})?

a) 0•2V   b) 0•7V   c) 2•2V   d) 10V

32. Referring to fig.7. The d.c. bias conditions are set so that the base current I_B is 20µA. What would be a suitable value of bleed current I_d in the divider chain R1 R2 to ensure reasonable stability of the base bias voltage?

a) 20µA b) 40µA c) 200µA d) 10mA

---

33. If the collector current increases due to the temperature or supply voltage increasing, the voltage across the emitter resistor R3 of fig.7 will-

a) increase. b) decrease.

c) remain the same. d) start to oscillate.

---

34. Referring to fig.7. If the voltage across R3 increases, the voltage V_{BE} will-

a) increase. b) decrease.

c) remain the same. d) reverse its polarity.

---

35. Referring to fig.7. If the voltage V_{BE} decreases due to an increase in voltage across the emitter resistor R3-

a) the bleed resistors R1 and R2 will overheat.

b) there will be excessive current drain on the battery and the electron flow will reverse.

c) there will be a reduction in I_B which causes a reduction in I_C which compensates for the original change.

d) the input current will increase to a point where carrier regeneration occurs and the amplifier will oscillate.

---

36. The effect of the emitter resistor R3 in fig.7 is to-

a) provide automatic stabilization and set the current I_E.

b) prevent heavy loading on the input stage.

c) set the battery supply voltage.

d) prevent excessive high frequency response in the amplifier.

37. If the emitter resistor R3 of fig.7, is not bypassed to a.c. signals by the capacitor C3-

a) negative feedback action will reduce the gain of the amplifier at the signal frequency.

b) positive feedback action of the circuit reduces the stability of the amplifier and the oscillation occurs.

c) it will not be possible to control the thermal runaway and the transistor will be destroyed.

d) it will become uneconomic to run the amplifier from a small battery and an expensive mains power unit will be required.

---

38. Between the input signal and output signal of a common emitter amplifier there is-

a) no phase shift.

b) a 90^{o} phase shift.

c) a 180^{o} phase shift.

d) a 360^{o} phase shift.

---

39. A transistor is basically a current amplifying device. How does the common emitter amplifier give a voltage gain?

a) The voltage gain is produced by the power supply when current is drawn and its temperature increases.

b) The voltage gain is a result of varying the leakage current flowing across the collector - base junction.

c) The voltage gain is the result of the signal controlled current I_C flowing in the collector load R_L, and causing the potential difference across R_L to vary in sympathy with it.

d) none of the above.

40. Referring to fig.7, what is the purpose of capacitors Cc?

a) They are the I/P and O/P coupling capacitors and prevent the d.c. conditions being altered by adjoining stages whilst allowing the a.c. signal to pass.

b) They are the I/P and O/P decoupling capacitors which allow the bias conditions to be transfered to the next stages as well as reducing the d.c. content of the signal.

c) They reduce the cost of manufacture as opposed to direct d.c. coupling.

d) They increase the gain by preventing free electrons escaping into the other circuits.

---

41. The input impedance of the common emitter amplifier is typically-

a) low, about 50Ω b) medium, about 2kΩ

c) high, about 10-50kΩ d) very high, about 1MΩ

---

42. The output impedance of the common emitter amplifier is typically-

a) low, about 50Ω b) medium, about 2kΩ

c) high, about 10-50kΩ d) very high, about 1MΩ

---

43. The common emitter amplifier would probably be used as a-

a) low input impedance VHF amplifier.

b) general purpose amplifier, low to mid frequencies.

c) buffer amplifier between high and low impedances.

d) high input impedance trigger device.

44. The circuit of fig.8 shows a-

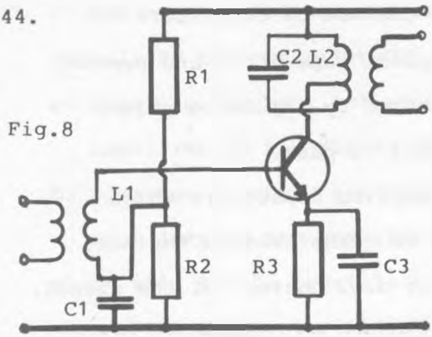


Fig.8

a) tuned collector, common emitter RF amplifier.

b) RF emitter follower.

c) common emitter, tuned collector oscillator.

d) negative slope oscillator.

---

45. For the circuit of fig.8, biasing and stabilization is provided by-

a) the tap on the coil L1.

b) the tuned circuit L2, C2.

c) L1, C1.

d) R1, R2 and R3.

---

46. Referring to fig.8, the capacitor C3 should be-

a) a very high voltage type, because of the voltage amplification of the coil.

b) a large 10,000µF, 1000V working electrolytic.

c) a very high impedance to the signal frequency.

d) a very low impedance to the signal frequency.

---

47. The tapping point on the coil L2 in fig.8, is to-

a) phase equalise the signal.

b) balance the self capacitance of the coil windings.

c) reduce the voltage before it reaches the collector.

d) achieve a good impedance match between the low impedance transistor and the high impedance parallel tuned circuit.

48. Referring to fig.8, the capacitor C1 is fitted to-

a) reduce the amplifier gain to prevent oscillation.

b) improve stability.

c) bypass R2 and give the a.c. input signals an easy path.

d) to reduce loading on the previous stage.

---

49. In a practical amplifier based on fig.8, the input and output circuits should be isolated and screened from each other-

a) to prevent external temperature increase altering the Q of the tuned circuits.

b) to prevent RF currents in R2 rendering R3 ineffective.

c) to reduce interaction between the coils L1 and L2, and reduce the possibility of self oscillation.

d) to protect the service engineer from burning his fingers when the coils get hot due to collector current flow. This is a 'Health and Safety at Work Act' requirement.

---

50. To convert the circuit shown in fig.8, into an oscillator, it is only necessary to-

a) solder a quartz crystal anywhere in the circuit.

b) increase the supply voltage to cause instability.

c) remove the decoupling capacitor C3.

d) inductively couple the coils L1 and L2 in the correct phase until oscillation commences.

51. Fig.9 shows the circuit of a-

a) tuned collector, common emitter amplifier.

b) RF emitter follower.

c) common emitter, tuned collector oscillator.

d) negative feedback oscillator.

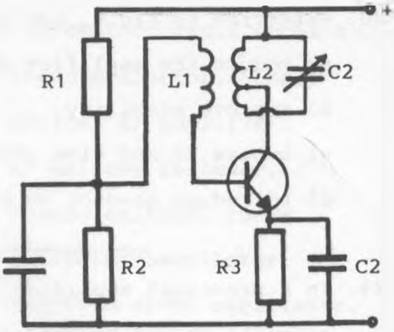


Fig.9

---

52. You have constructed the circuit fig.9, but although it and all its components test O.K. it still will not oscillate. What is the most likely cause? Remember, all the components and voltages test O.K.

a) The battery has been overcharged and allowing an excess of electrons to flow.

b) The feedback coil is reversed, causing negative feedback instead of positive feedback.

c) A zener diode has to be fitted to stabilize the voltage.

d) Do not worry, it will oscill, later.

---

53. Referring to fig.9, the frequency of oscillation is determined by-

a) R3 and C3.

b) C2 and L1.

c) the parallel tuned circuit L2 and C2.

d) the series circuit, consisting L1 and C1.

---

54. The circuit shown in fig.9, will only oscillate when-

a) there is sporadic E about.

b) I_B is equal to I_E.

c) there is enough gain in the amplifier to overcome the losses in the circuit.

d) none of the above.

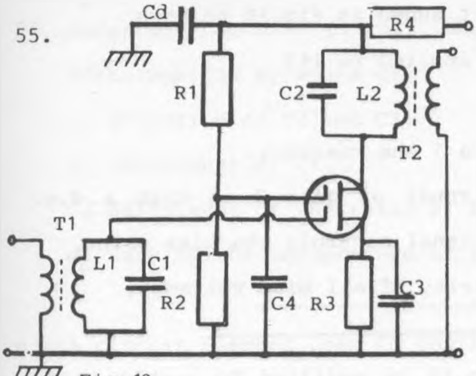
55. 

Fig.10

The circuit shown in fig.10 is that of a typical-

a) bi-polar FET oscillator.

b) dual gate MOSFET oscillator.

c) dual gate MOSFET radio frequency amplifier.

d) dual gate DIAC mixer stage, with full negative feedback.

---

56. Biasing and stabilization of the above circuit is provided by-

a) T1 and C1.

b) R1, R2 and R3.

c) R4 and Cd.

d) C4 and R4.

---

57. Referring to fig.10. It has not been found necessary to tap the drain connection down the coil, this is because-

a) the high output impedance of the MOSFET is a reasonable match to the high impedance cuned circuit.

b) there is a saving in supply current to be gained.

c) the type of coil used is not manufactured with a tap.

d) the tapping point is now provided by the R4 Cd junction.

---

58. Referring to fig.10. The capacitor Cd and resistor R4-

a) decouple the power supply from RF currents.

b) provide a suitable matching point for the tuned circuit.

c) stabilize the supply voltage.

d) provide a feedback path for easy oscillation.

59. Is it possible for the circuit shown in fig.10 to have automatic gain control (AGC) applied to it?

a) No.

b) Yes, by replacing C2 with a 1 ohm resistor.

c) Yes, by arranging the circuit of gate 2 so that a d.c. voltage derived from the signal controls the bias point.

d) Yes, by reversing the polarity of all bias voltages.

---

60. How could the circuit of fig.10 be modified to enable it to be used as a mixer stage?

a) Inject the local oscillator to a centre tap on the power supply and inject the signal at gate 2.

b) insert germanium diodes across both gates and inject the local oscillator at the R4 Cd junction.

c) Short circuit the primary of T1 and inject both signals at the battery centre tap.

d) Change the values of R1 and R2 to suit the MOSFET and inject the local oscillator via a capacitor to the G2, R1 and R2 junction. Tune C2 L2 to required mixer product.

61.

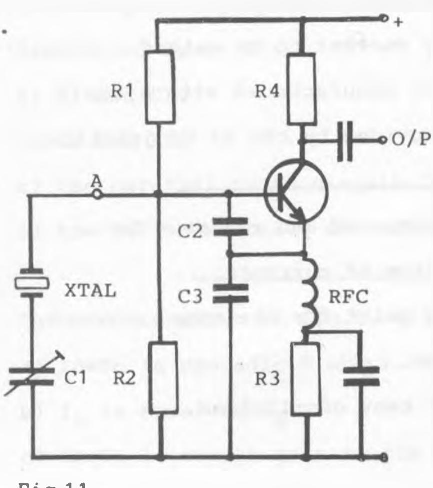


Fig.11

The circuit shown in fig.11 is that of a typical-

a) crystal microphone amplifier.

b) crystal filter stage.

c) IF amplifier stage.

d) crystal oscillator.

62. Referring to the circuit shown in fig.11. Fine frequency adjustment is by means of-

a) selection of C2 and C3.

b) adjustment of C1.

c) adjustment of the ratio R1 R2.

d) varying the temperature of the crystal.

---

63. A circuit element used to control the frequency of an oscillator to a very close tolerance is a-

a) varactor diode.

b) thermistor.

c) parallel tuned circuit.

d) quartz crystal.

64.

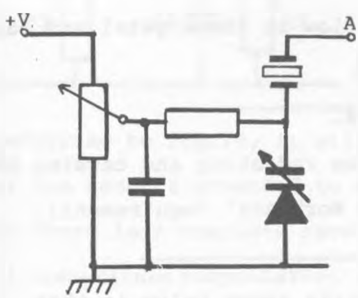


Fig.12

When the crystal circuit at point A, fig.11 is replaced by the circuit shown in fig.12, the circuit is suitable as -

a) an oscillator with receive independant tuning,(RIT).

b) an ultra stable oscillator.

c) a voltage regulator.

d) a crystal mixer circuit.

---

65. The item referred to today as a 'crystal' is actually-

a) a thin slice of quartz, with an electrode fixed to each face and enclosed in a small sealed container.

b) a slice of semiconductor material suspended in rubber.

c) a 1920's device that employs a cats whisker.

d) a cube of copper sulphate with electrodes fixed to each face.

66. When the quartz crystal in the circuit of fig.11 receives an 'electric shock' from the feedback circuit of the oscillator, it will-

a) shatter the quartz into microscopic pieces which reform later.

b) become purely inductive and return power to the circuit.

c) chemically change to silicon, and decompose.

d) vibrate, producing an e.m.f. across its faces at its natural resonant frequency. This action being maintained by the amplifier.

---

67. The amount of feedback applied in a quartz crystal oscillator circuit is restricted to that just necessary to allow easy starting, this ensures that-

a) the crystal doesn't pop out of its socket at switch-on.

b) excessive RF current doesn't flow in the crystal and cause it to overheat and fracture.

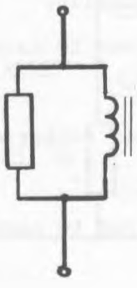
c) the battery power is conserved.

d) the transistor is pevented from radiating and causing RF burns. ('Health and Safety at Work Act' requirement).

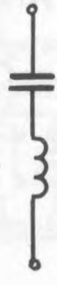
---

68. Which one of the equivalent circuits shown below is that of a 'quartz crystal'?

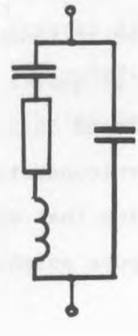
a)



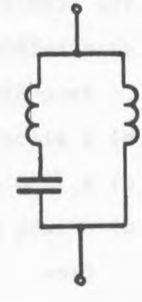
b)



c)



d)



69. If the collector circuit of fig.11 is replaced by that of fig.13, and the L,C circuit tuned to three times the crystal frequency (3 x fc), the circuit may be used as a-

a) frequency multiplier.

b) harmonic trap.

c) bandwidth limiter.

d) comb generator.

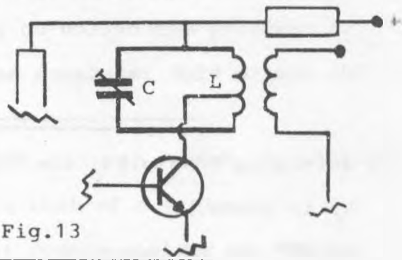


Fig.13

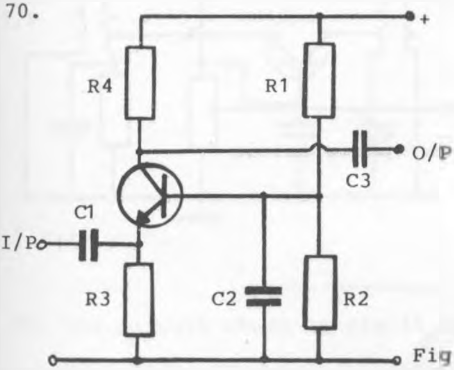
70. 

Fig.14

The circuit diagram shown in fig.14, is that of a-

a) common emitter amplifier.

b) common base amplifier.

c) common collector amplifier.

d) common drain amplifier.

71. Referring to fig.14, it will be seen that-

a) the base is grounded to RF currents by C2.

b) there is a complete reversal of supply voltage.

c) temperature compensation is provided by C1 and C3.

d) a very special type of NPN transistor has been used.

72. With the configuration of fig.14, the current gain is-

a) approximately 50.

b) approximately 200.

c) always less than 1.

d) always greater than 1.

73. The common base circuit is a useful circuit for-

a) providing E.H.T. for cathode ray tubes.

b) suppressing mains spikes and transients.

c) reducing distortion on perfect sine-waves.

d) low to high impedance matching.

---

74. Referring to fig.14, the input and output signals are-

a) in phase.

b) 90^{0} out of phase.

c) 180^{0} out of phase.

d) 270^{0} out of phase.

---

75. Referring to fig.14, the base bias potential is maintained by-

a) resistors R1 and R2.

b) resistors R4 and R3.

c) resistors R1 and R3.

d) capacitor C2.

---

76. Referring to fig.14, the emitter current is stabilized by-

a) resistors R1 and R2.

b) resistors R4 and R3.

c) resistors R1 and R3.

d) resistor R3.

---

77. The input impedance of the common base amplifier is-

a) low, 50Ω - 500Ω

b) medium, 1000Ω - 2500Ω

c) high, 3000Ω - 10,000Ω

d) very high, 10,000Ω - 500,000Ω

78. The output impedance of a common base amplifier is typically-

a) low, 50Ω - 500Ω

b) medium, 1000Ω - 2500Ω

c) high, 3000Ω - 10,000Ω

d) very high, 50,000Ω - 500,000Ω

79.

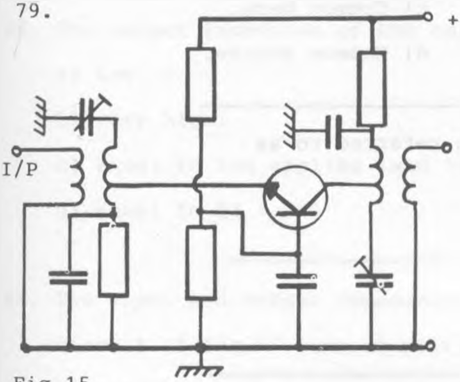


Fig.15

The circuit shown in fig.15 is that of a typical-

a) common emitter oscillator.

b) common collector radio frequency amplifier.

c) common base radio frequency amplifier.

d) common gate radio frequency amplifier.

---

80. The circuit shown in fig.15 is often used where-

a) a radio frequency amplifier with wide bandwidth and low input impedance is required.

b) very high power gain and high current gain is required.

c) a high powered oscillator is necessary.

d) extra low current drain is necessary.

81.

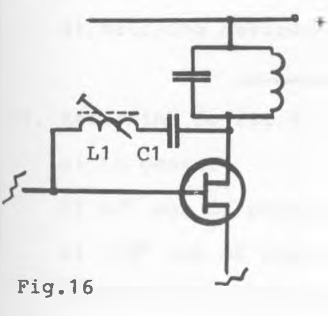


Fig.16

The circuit shown in fig.16 is part of a common source FET amplifier, what is the purpose of L1 and C1?

a) It increases the sensitivity.

b) It increases the current gain.

c) It neutralizes the drain - gate 'Miller' capacitance.

d) It is not necessary.

82.

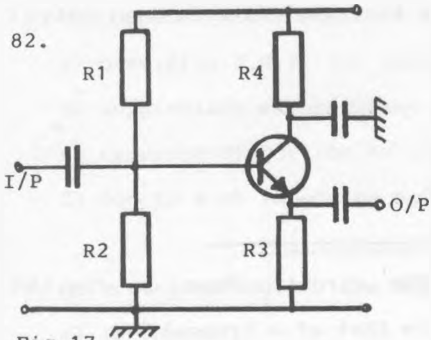


Fig.17

What is the configuration of the amplifier circuit shown in fig.17?

a) Common collector.

b) Common emitter.

c) Common base.

d) Common source.

83. The circuit shown in fig.17 is referred to as -

a) a collector follower.

b) an emitter follower.

c) a base follower.

d) an emitter feeder.

84. What voltage gain would you expect from the amplifier circuit shown in fig.17?

a) Less than 1.

b) Greater than 1.

c) About 50.

d) About 200.

85. The current gain of the amplifier shown in fig.17 is typically-

a) 0•98.

b) 1•0.

c) usually better than 50.

d) 1000.

86. The circuit shown in fig.17 has-

a) a high power gain.

b) a low power gain.

c) unity power gain.

d) no power gain, only a loss.

87. The input impedance of the emitter follower is-

a) high.

b) low.

c) equal to the source resistance.

d) equal to R3.

---

88. The output impedance of the emitter follower is-

a) low.

b) very high.

c) equal to the applied load impedance.

d) equal to R3 + R4.

---

89. The input and output impedances of the common collector circuit of fig.17 make it suitable for-

a) matching high to low impedance circuits.

b) matching low to high impedance circuits.

c) phase shifting.

d) earth protection circuits.

---

90. One very good use for the emitter follower circuit shown in fig.17 would be as a-

a) buffer amplifier for a VFO.

b) frequency converter.

c) high voltage amplifier.

d) matching device for a folded dipole.

---

91. Referring to fig.17, the input and output signals are-

a) in phase.

b) 90° out of phase.

c) 180° out of phase.

d) 270° out of phase.

92. Referring to fig.17, which one of the following statements is correct?

a) Negative feedback voltage is developed across R3.

b) positive feedback voltage is developed across R4.

c) There. is no feedback employed in the emitter follower.

d) None of the above are true.

---

93. If the resistor R2 is omitted from the circuit shown in fig.17-

a) the input impedance will be reduced.

b) the input impedance will be increased.

c) excessive current drain on the battery will occur.

d) there will be a signal phase change between input and output.

94.

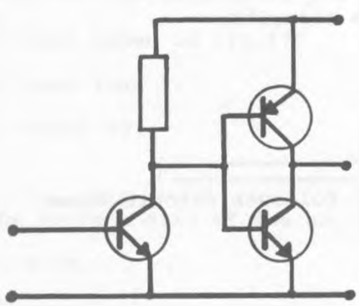


Fig.18

The circuit shown in fig.18 is the basic circuit for a-

a) series power regulator.

b) high speed electronic relay

c) device for testing NPN transistors.

d) class B complementary push-pull output stage.

---

95. Correct biasing for the amplifier shown in fig.18 is necessary in order to prevent-

a) miller feedback.

b) piezo-electric effect feedback.

c) common mode signal rejection.

d) cross-over distortion.

96.

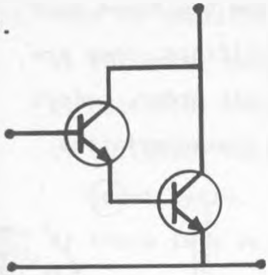


Fig.19

The transistor arrangement shown in fig.19 is known as a-

a) feedback pair.

b) base limiter.

c) Cardington pair.

d) Darlington pair.

---

97. The arrangement shown in fig.19 above can be considered as a single transistor-

a) which requires no supply current for its operation.

b) whose temperature decreases as its power dissipation increases.

c) that has extremely low gain and low sensitivity.

d) that has extremely high gain and high sensitivity.

---

98. A suitable application for the transistor configuration shown in fig.19 is as a-

a) negative temperature stabilizer.

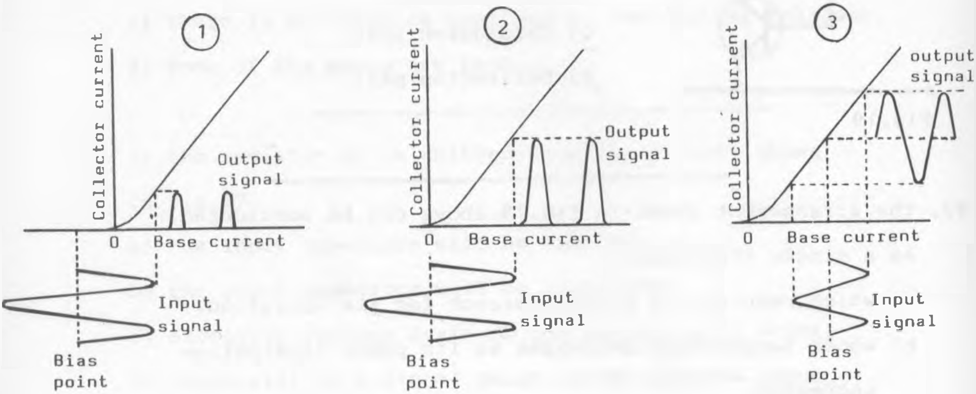
b) power attenuator.

c) 5kV voltage regulator.

d) relay or lamp driver.

---

99. The input/output characteristics below, show the three main classes of bias applied to transistor amplifiers, they are class A, B and C, but not necessarily in that order, select the correct order from the list below the characteristics.



a)			b)			c)			d)		
1	Class	A	1	Class	C	1	class	B	1	Class	C
2	"	B	2	"	A	2	"	C	2	"	B
3	"	C	3	"	B	3	"	A	3	"	A

100. Class A operation is-

a) the most efficient but least linear of the three classes.

b) the least efficient but most linear of the three classes.

c) no better than the others for efficiency.

d) the least efficient and least linear of the three classes.

101. Class C operation is-

a) the most efficient but least linear of the three classes.

b) the most efficient and most linear of the three classes.

c) the least linear and least efficient of the three classes.

d) no better than any of the others for efficiency.

102. When an amplifier is operating under class B bias conditions-

a) collector current flows for the whole of the input cycle.

b) collector current flows for about half of the input cycle.

c) collector current flows for only a small part of the input cycle.

d) there is a very high quiescent collector current.

---

103. When an amplifier is operating under class C bias conditions-

a) collector current flows for the whole of the input cycle.

b) collector current flows for less than half of each input cycle.

c) there is a very high quiescent collector current.

d) there is a medium quiescent collector current.

---

104. Class A operation is the least efficient because-

a) power supplies will not handle this type of operation.

b) large input signal powers are required.

c) there is always a collector current flowing, even when no input signal is present.

d) the base current is usually zero.

---

105. Class C operation is normally used in-

a) high quality audio amplifiers.

b) push-pull audio amplifier stages for maximum linearity.

c) tuned radio frequency amplifier stages.

d) distortionless microphone amplifiers.

---

106. The theoretical efficiency of a class B amplifier is-

a) 100% b) 78% c) 50% d) 25%

10. SEMICONDUCTORS

1	d	31	a	61	d	91	a
2	b	32	c	62	b	92	a
3	c	33	a	63	d	93	b
4	d	34	b	64	a	94	d
5	a	35	c	65	a	95	d
6	c	36	a	66	d	96	d
7	a	37	a	67	b	97	d
8	a	38	c	68	c	98	d
9	d	39	c	69	a	99	d
10	a	40	a	70	b	100	b
11	d	41	b	71	a	101	a
12	b	42	c	72	c	102	b
13	a	43	b	73	d	103	b
14	d	44	a	74	a	104	c
15	c	45	d	75	a	105	c
16	b	46	d	76	d	106	b
17	a	47	d	77	a		
18	a	48	c	78	d		
19	b	49	c	79	c		
20	b	50	d	80	a		
21	a	51	c	81	c		
22	b	52	b	82	a		
23	b	53	c	83	b		
24	a	54	c	84	a		
25	c	55	c	85	c		
26	c	56	b	86	a		
27	b	57	a	87	a		
28	d	58	a	88	a		
29	c	59	c	89	a		
30	b	60	d	90	a		

11. POWER SUPPLIES

1. A transformer is constructed of two or more coils possessing-

   a) ferromagnetic bonding.

   b) eddy current losses.

   c) electrostatic coupling.

   d) mutual inductance.

---

2. The windings of a transformer introduce a loss, this is referred to as-

   a) feedback loss.

   b) hysteresis loss.

   c) eddy current loss.

   d) copper loss.

---

3. The two types of loss associated with a transformer core are-

   a) electromagnetic and ferromagnetic.

   b) inductive and capacitive.

   c) iron oxide and carbon.

   d) hysteresis and eddy current.

---

4. How are the core losses referred to in Q 3 above reduced?

   a) By fitting an electrostatic screen between the two windings.

   b) By fitting a magnetic screen between the two windings.

   c) By reduction of the oxide and carbon levels in the core.

   d) By constructing the core of thin, insulated ferromagnetic laminations.

5. Transformer power losses cause-

   a) feedback of power into the mains.

   b) local neon signs to flicker.

   c) the load to over-heat.

   d) the temperature of the transformers core and windings to increase.

---

6. When a foil screen is inserted between the primary and secondary windings of a transformer-

   a) it must act as a short circuit turn to be effective.

   b) it must not act as a short circuit turn.

   c) it must be made of polythene.

   d) it must be at least two wavelengths of the mains frequency long.

---

7. The screen of a transformer, when fitted, should be connected to-

   a) earth.
   b) H.T. positive.

   c) mains live.
   d) mains neutral.

---

8. What is the purpose of the transformer screen?

   a) It is a safety measure to isolate the primary and secondary, and also to provide an electrostatic screen.

   b) It is to create a very high circulating current which reduces the transformer 'Q', making it suitable for operation at 25, 50, 60 and 100 Hertz.

   c) It provides a low voltage reference source.

   d) It is fitted during construction to prevent the turns of the coil unwinding.

9\. The transformer shown in fig.1 has 100 turns on the primary and 200 turns on the secondary. What is the secondary voltage?

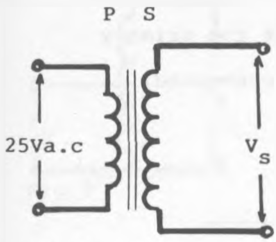


Fig.1

a) 12·5V b) 25V

c) 37·5V d) 50V

10\. The 10V secondary winding of a transformer is rated at 20VA, what current would you expect it to be capable of supplying?

a) 0·5A b) 2A c) 10A d) 20A

11\. What is the desired coefficient of coupling for mains transformers?

a) K = 0 b) K = 0·5 c) K = 1 d) K = 100

12\. The voltage ratio between the primary and secondary of a transformer is-

a) dependant on the supply current.

b) directly proportional to the turns ratio.

c) inversely proportional to the turns ratio.

d) proportional to (turns ratio squared) T^2.

13\. A transformer with a 4:1 step-up ratio, has 240V.a.c. applied to the primary. What voltage will be measured at the secondary?

a) 60V b) 120V c) 240V d) 960V

14. Assuming a near perfect transformer, that is one with an infinitely low loss, what would you expect the primary current to be, when no secondary load is connected?

a) Infinitely high.

b) infinitely low.

c) 10 A in all cases.

d) Normally about 1mA.

---

15. In addition to transforming voltages, the transformer can also be used for-

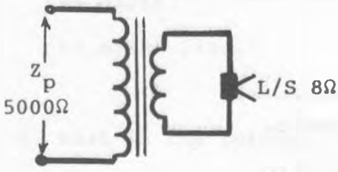
a) reducing vibration in HF crystal oscillators.

b) producing a highly stable reference frequency from the variable mains frequency of 50Hz.

c) impedance matching.

d) transforming d.c. voltages and currents.

16.



An amplifier requires a 5000Ω load but it has to drive an 8Ω loudspeaker, so a matching transformer is used, what is the turns ratio N_p / N_s of the transformer?

a) 25:1 b) 5000:8

c) 625:1 d) 200:1

17.

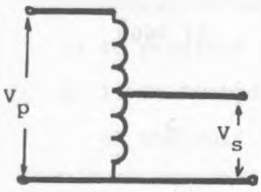


Fig.2

Fig.2 shows a-

a) voltage variable inductor.

b) current variable inductor.

c) step-up auto transformer.

d) step-down auto transformer.

18.

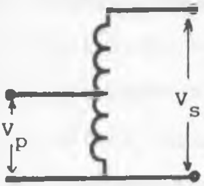


Fig.3

Fig.3 shows a-

a) reactance variable transformer.

b) oscillating transformer.

c) step-up auto transformer.

d) step-down auto transformer.

---

19. An auto transformer-

a) is only suitable for low current applications.

b) is not suitable for low current applications.

c) does not provide isolation between primary and secondary.

d) has to be purchased on a special license issued by the DHSS. (Health and Safety at work act requirement).

20.

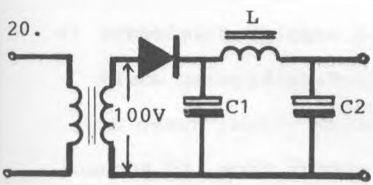


Fig.4

Referring to fig.4, the type of rectification employed is-

a) quarter wave.

b) half wave.

c) three quarter wave.

d) full wave.

---

21. The minimum 'Peak Inverse Voltage' (PIV) across the diode in the circuit of fig.4 is-

a) 100V b) 141V c) 200V d) 282V

---

22. What is the output voltage of the power supply unit shown in fig.4 when there is no load connected?

a) 100V b) 141V c) 200V d) 282V

23. What working voltage would you select for the capacitors to be used in the filter circuit of fig.4?

a) 100V b) 150V c) 300V d) 1000V

---

24. What is the purpose of C1, C2 and L in the power supply unit shown in fig.4?

a) They form the ripple filter or low pass filter for smoothing the rectified output. C1 is the reservoir capacitor.

b) They form a voltage doubling circuit to make up for the loss in the rectifiers.

c) They make up the voltage regulator.

d) They provide the bias for the transformer.

---

25. If the power supply shown in fig.4 is supplying an audio amplifier and the capacitors go open circuit, what would be the most noticeable effect?

a) The receiver would transmit R.F. energy from its antenna.

b) The transformer would burn up.

c) There would be a loud hum at the loudspeaker.

d) The turntable, if used, would go into reverse.

26.

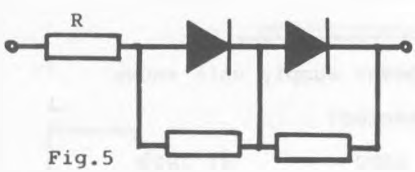


Fig.5

If the diode rectifier used in the circuit of fig.4, is substituted for two diodes in series, as shown in fig.5, what is the PIV across each diode?

a) 100V b) 141V

c) 200V d) 282V

27. The resistors fitted across the series connected diodes of fig.5 are to-

a) pass more supply current to the load.

b) assist the fuse to blow if the capacitors go faulty.

c) equalise the reverse (or inverse) voltages.

d) bias the diodes into conduction.

---

28. Referring to fig.5. If fitted, the resistor 'R' is to-

a) act as a current sensor to enable the current to be measured easily.

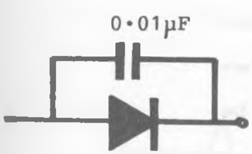
b) prevent high peak inverse voltages destroying the diode.

c) reduce the diode surge current to safe limits at switch-on.

d) satisfy the purists, they dont know why they fit it but as it has always been fitted they continue to do so, it is never really necessary.

---

29. Rectifier diodes will often be found with small capacitors fitted across them, as shown below, what is the reason?



a) To increase the working voltage.

b) To increase the rated current.

c) To bypass rapid high voltage spikes or transients, which could damage the diode.

d) To provide protection for the transformer should the diode go short-circuit.

30.

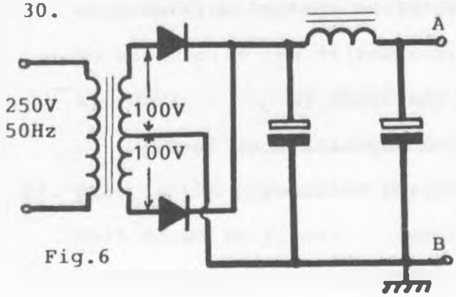


Fig.6

What type of rectification is employed in the power supply unit shown in fig.6?

a) Quarter wave.

b) Half wave.

c) Three quarter wave.

d) Full wave.

---

31. The PIV across each diode shown in fig.6 will be-

a) 70·7V b) 141V c) 200V d) 282V

---

32. Under no-load conditions, the output measured at A - B will be about-

a) 70·7V b) 100V c) 141V d) 200V

33.

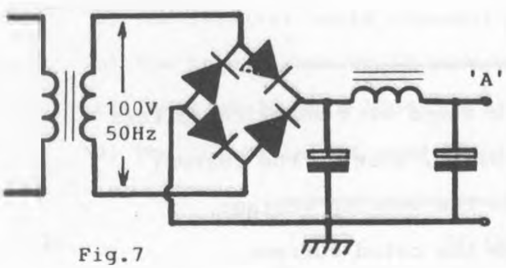


Fig.7

Fig.7 shows the circuit of a power supply. What type of rectification does it use?

a) Quarter wave.

b) Half wave.

c) Full wave bridge.

d) Quadro-phase.

---

34. The PIV across each diode shown in fig.7 will be-

a) 63V b) 100V c) 141V d) 282V

---

35. The polarity of the voltage at point 'A' in fig.7 is-

a) positive. b) negative.

c) neutral. d) negative 20V.

36. What is the ripple frequency of the full wave rectifier circuits shown in figures 6 and 7?

a) 50Hz. b) 100Hz. c) 141Hz. d) 400Hz

---

37. The ripple voltage at the output of the power supplies shown in figures 4, 6 and 7, is largely dependent upon-

a) the value of the capacitors and the load current.

b) the power rating of the load.

c) the stability of the mains supply.

d) the material used for the transformer core.

38.

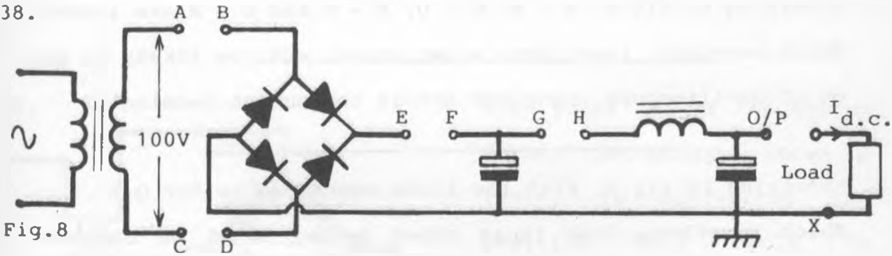
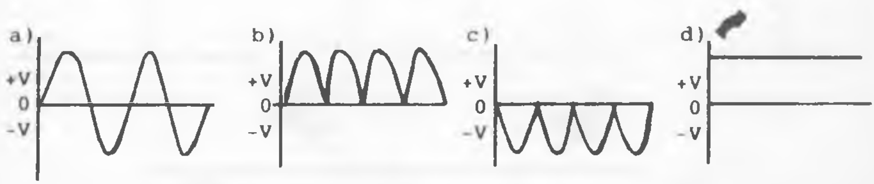


Fig.8

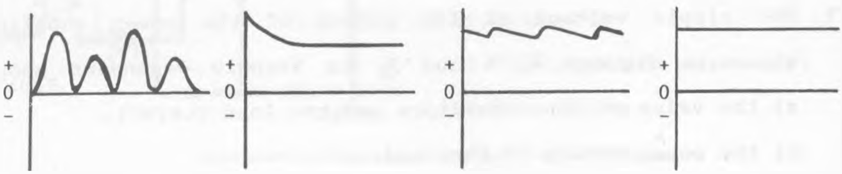
Fig.8 shows a PSU employing a full wave bridge rectifier and capacitor input filter. Using an oscilloscope, which waveform from those shown below, would you expect to see at points A-C?



39. Referring to fig.8. When points A - B and C - D are linked, which one of the above waveforms would you expect to see on an oscilloscope connected across points E and X?

40. Referring to fig.8. A - B, C - D and E - F are linked. Which waveform, from those shown below, would you expect across points G and X?

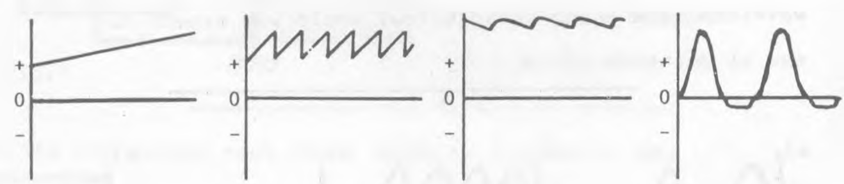
a) b) c) d)



41. Referring to fig.8. A - B, C - D, E - F and G - H are linked. Which waveform, from those shown above, are you likely to see on an oscilloscope connected across the output terminals?

42. Referring to fig.8. With the links connected as for Q 41. Which waveform, from those shown below, might be observed at the output terminals when a load is connected which draws the maximum rated current of the PSU?

a) b) c) d)



43. The a.c. supply frequency to the PSU shown in fig.8 is 50Hz. What is the ripple frequency?

a) 25Hz b) 50Hz c) 100Hz d) 796Hz

44. Referring to fig.8. With all the links, and the load connected. What is the average current flowing in each of the rectifiers?

a) Id.c. b) 0·5 x Id.c. c) 0·7 x Id.c. d) 2 x Id.c.

---

45. The average current in each one of the rectifiers shown in fig.6 is-

a) twice the average output current.

b) the same as the output current.

c) half of the average output current.

d) a quarter of the average output current.

46.

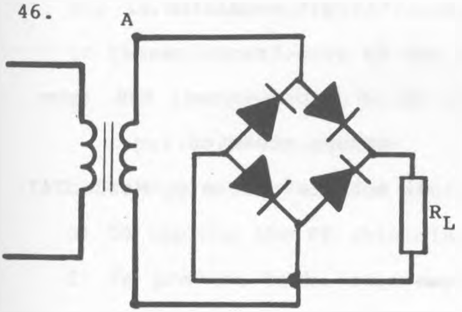
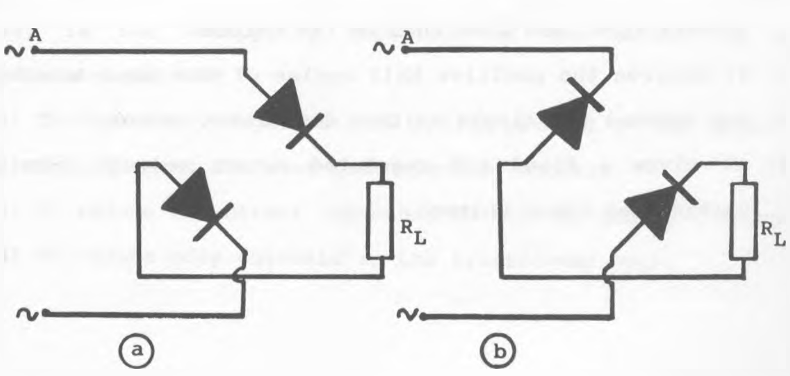


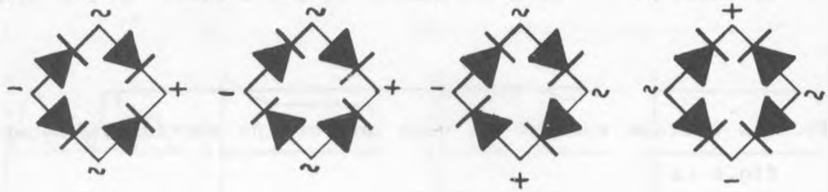
Fig.9

When point 'A' of the transformer secondary, shown in fig.9, is delivering the positive half cycle to the rectifier bridge, what is the path taken by the current? choose your answer from a) or b) below.



47. Which one of the bridge rectifier circuits shown below is correct?

a) b) c) d)



48. Power supply design for the amateur is simplified by including box 'X' in the circuit shown in fig.10.

What is box 'X'?

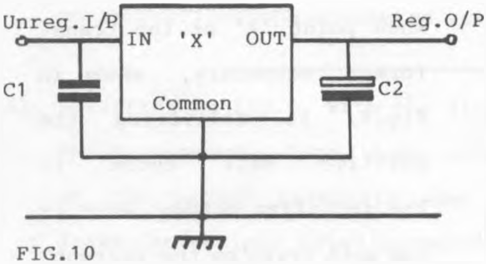


FIG.10

a) A fixed voltage integrated circuit regulator.

b) An auto transformer.

c) A non-linear 500 ohm carbon resistor.

d) A thyratron. e.g. Mazda T41.

49. What is the function of box 'X' fig.10?

a) It prevents oscillation in the bridge rectifier.

b) It removes the negative half cycles from the input waveform, inverts them, and adds them to the output.

c) It squares the positive half cycles of the input waveform and reduces the ripple voltage distortion factor.

d) It gives a fixed and regulated output voltage from an unregulated input voltage.

50\.

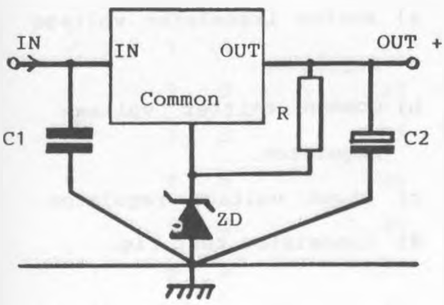


Fig.11

Referring to fig.11. Why has the zener diode been included in the circuit?

a) To increase the current rating of the regulator.

b) To increase the current rating of the transformer.

c) To increase the output voltage of the regulator.

d) To increase the power rating of the rectifier.

51\. Why is it advisable to connect a decoupling capacitor close to the input terminal of the regulator? e.g. C1 in fig.11.

a) To increase the peak input voltage available at the input to the regulator.

b) To square the voltage available at the regulator output.

c) To improve the RF shielding of the silicon substrate.

d) To prevent high frequency instability which might reduce the regulation and efficiency.

52\. Why is the decoupling capacitor at the output of the regulator fitted?

a) To bypass any negative half cycles present at the output.

b) To safeguard the user from electric shocks.

c) To reduce the output impedance to high frequency currents.

d) To reduce eddy currents in the transformer core.

53.

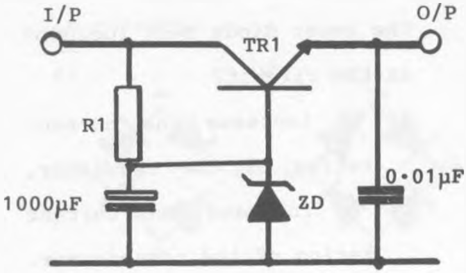


Fig.12

The circuit shown in fig.12 is that of a typical-

a) series transistor voltage regulator.

b) common emitter voltage regulator.

c) shunt voltage regulator.

d) transistor test rig.

---

54. Referring to fig.12. Transistor TR1 can be regarded as-

a) a common emitter d.c. amplifier.

b) a collector follower d.c. amplifier.

c) An emitter follower d.c. amplifier.

d) a flip-flop circuit.

---

55. Where are bleed resistors fitted in power supplies?

a) Across the transformer.

b) Across the mains input.

c) Across the rectifiers.

d) Across high value capacitors.

---

56. Why are bleed resistors fitted?

a) To reduce the risk of damage due to lightning strikes.

b) To discharge antenna static.

c) To reduce mains borne interference.

d) As a safety precaution to discharge the capacitors when the equipment is switched off.

11. POWER SUPPLIES

1	d	21	d	41	d
2	d	22	b	42	c
3	d	23	b	43	c
4	d	24	a	44	b
5	d	25	c	45	c
6	b	26	b	46	a
7	a	27	c	47	a
8	a	28	c	48	a
9	d	29	c	49	d
10	b	30	d	50	c
11	c	31	d	51	d
12	b	32	c	52	c
13	d	33	c	53	a
14	b	34	c	54	c
15	c	35	a	55	d
16	a	36	b	56	d
17	d	37	a		
18	c	38	a		
19	c	39	b		
20	b	40	d		

12. RADIO RECEIVERS

1. The first function of a radio receiver is to-

   a) detect the presence of all the signals on the antenna.

   b) absorb all the signals radiated in close proximity to the antenna.

   c) select the wanted signal from the unwanted signals present at the receiver input.

   d) act as a broad-band spectrum monitor.

---

2. In its most basic form, a radio receiver need only consist of-

   a) a tuned circuit, diode detector and headphones.

   b) two tuned circuits, product detector, audio amplifier and headphones.

   c) a radio frequency amplifier, an intermediate frequency amplifier and a small 100mW loudspeaker.

   d) two resistors, a 1·5 volt battery and headphones.

---

3. The crystal set was among the earliest of basic receivers, but following closely came the TRF (tuned radio frequency) receiver, known as the 'straight set' because-

   a) it was first supplied straight from the manufacturer to the listener.

   b) it required a long straight antenna.

   c) it was first used successfully in the 'Straits of Dover'. It should really be called a 'Dover·Strait set'.

   d) the signal path is straight from the antenna and RF stages to the detector stage, with no intermediate frequency conversion.

4. One of the problems associated with the straight set is-

a) that it required valves which were unobtainable when it was first invented.

b) its lack of selectivity, instability, and varying gain over its tuning range.

c) that it requires physically large tuning components that are not very practical to manufacture.

d) that being of early 1920's design it was intended to be powered by wet Leclanche cells, not obtainable today.

---

5. An increase in sensitivity in certain types of TRF receivers is gained by including an oscillating detector stage, these receivers are known as-

a) superheterodyne receivers.

b) degenerative and superdegenerative receivers.

c) regenerative and superregenerative receivers.

d) superoscillative receivers.

---

6. One of the major problems associated with the type of receiver referred to in Q5 above is-

a) oscillator radiation.

b) heavy power supply drain.

c) that they will not receive CW signals.

d) that they are bulky and expensive.

---

7. The problems of the TRF receiver were overcome in the 1930's by the introduction of the-

a) superheterodyne receiver. b) degenerative receiver.

c) superlative receiver. d) phase-locked receiver.

8. The superheterodyne receiver is one in which-

a) the signal frequency and the intermediate frequency are mixed to produce the audio output.

b) the signal frequency and the local oscillator frequency are mixed to produce the intermediate frequency.

c) the signal frequency and the intermediate frequency are mixed to produce the beat frequency.

d) there is no selectivity in the IF stage.

9.

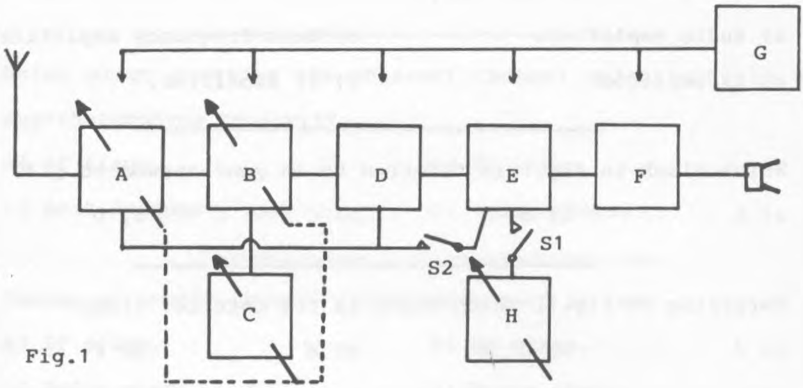


Fig.1

Fig.1 above shows the block diagram of a basic superheterodyne receiver. What is block A?

a) Audio amplifier.

b) tuning dial.

c) Local oscillator.

d) RF amplifier.

---

10. What is the function of the RF amplifier in a superheterodyne receiver?

a) It matches the crystal to the mixer stage.

b) It prevents the audio signals radiating from the antenna.

c) It is a throw-back from the 1930's. Not necessary today.

d) It improves the noise figure of the receiver, reduces image channel interference and reduces local oscillator radiation.

11. What is block C fig.1?

a) Audio amplifier.   b) Power regulator.

c) Local oscillator.   d) RF amplifier.

---

12. What is block B fig.1?

a) Detector stage.   b) Mixer stage.

c) Local oscillator.   d) IF amplifier.

---

13. Which stage in a superheterodyne receiver provides the bulk of the gain and selectivity?

a) Audio amplifier.   b) Beat frequency amplifier.

c) RF amplifier   d) IF amplifier.

---

14. Which block in fig.1 is referred to in your answer to Q13?

a) A   b) B   c) C   d) D

---

15. Referring to fig.1. Which block is the detector stage?

a) C   b) D   c) E   d) F

---

16. The detector stages in a good communication receiver should be capable of handling-

a) very large power supply changes.

b) high voltage surges due to lightning strikes.

c) FM, AM, SSB and CW signals.

d) foreign languages.

---

17. What is block G fig.1?

a) The power supply.   b) The AGC detector.

c) The tuning control.   d) The negative feedback stage

18. What is block F fig.1?

a) Power supply unit. b) Mains transformer.

c) Detector stage. d) Audio amplifier.

---

19. Referring to fig.1. What is the required frequency at the output of the mixer stage?

a) Local oscillator frequency.

b) Incoming signal frequency.

c) Intermediate frequency.

d) Audio frequency.

---

20. Which stage provides the adjacent channel selectivity in the superheterodyne receiver?

a) IF stage. b) RF stage.

c) Beat frequency osc: d) Audio stage.

---

21. Image, or second channel rejection occurs in the-

a) IF stage. b) RF stage.

c) Audio stage. d) Mixer stage.

---

22. Which stage of a superhet reduces the level of local oscillator signal which might be fed back to the antenna?

a) IF stage. b) RF stage.

c) Mixer stage. d) AGC amplifier.

---

23. What is box H fig.1?

a) Product detector. b) Second detector.

c) Band pass filter. d) BFO.

24. The process known as heterodyning is-

a) not recommended, as it produces many unwanted frequencies.

b) the addition, in a linear detection device, of d.c. currents to produce an intermediate d.c. voltage.

c) the combination of two different high frequency currents to produce a current at a third frequency.

d) The conversion of two different modulated RF signals into their d.c. states.

25.

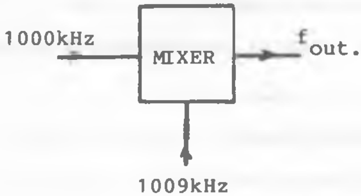


Fig.2

If two frequencies, as shown in fig.2, are applied to the input of a mixer stage which uses a single diode, which set of frequencies from the list below would you expect to be present at the output?

a) 1000kHz

b) 1009kHz

c) 9 and 2009kHz

d) 9, 1000, 1009 and 2009kHz

---

26. The mixer, or frequency changer stage of a superheterodyne receiver is shown in fig.3, the local oscillator frequency f_o is usually higher than the signal frequency by the-

a) signal frequency, $f_o=f_s+f_s$.

b) audio frequency, $f_o=f_s+f_a$.

c) intermediate frequency, $f_o=f_s+f_{if}$.

d) image frequency, $f_o=f_s+f_{if}$.

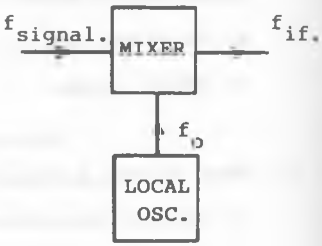


Fig.3

27.

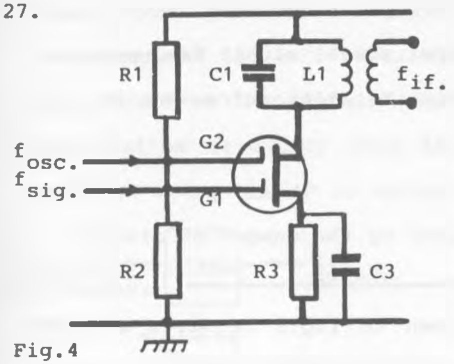


Fig.4

Fig.4 shows the circuit of a basic MOSFET mixer stage, the tuned circuit L1 C1 should be tuned to the-

a) RF signal frequency.

b) intermediate frequency.

c) oscillator frequency.

d) image frequency.

---

28. Referring to fig.4. The input impedance of G1 and G2 is high, and there is considerable isolation between them, therefore-

a) the power supplied by the local oscillator is negligible, there is minimum local oscillator pulling, and good isolation between the local oscillator and the antenna.

b) the local oscillator must supply at least 3·8 watts of RF power and be buffered from the incoming signal.

c) the device is very inefficient.

d) there must be a distortionless signal present.

29.

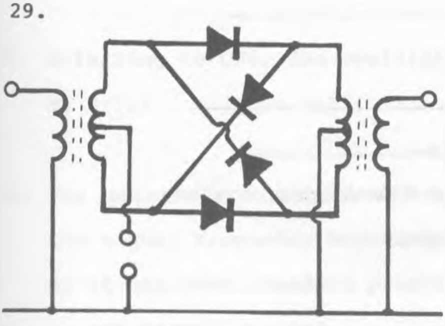


Fig.5

Fig.5 shows the circuit of a-

a) voltage multiplier.

b) voltage control circuit.

c) double balanced mixer circuit.

d) quadro-phase mixer circuit.

30. The circuit shown in fig.5-

a) produces a high voltage output at the signal frequency.

b) suppresses the input and local oscillator frequencies and produces two sidebands.

c) produces the AGC voltage.

d) multiplies the input frequency by the number of diodes.

---

31. The type of mixer circuit shown in fig.5 requires a higher local oscillator drive level than the MOSFET mixer of fig.4, and is usually used where-

a) a good intermodulation and cross modulation performance is required.

b) the supply voltage is likely to vary.

c) economy of cost is essential.

d) space will not allow transistors to be fitted.

---

32. Normally transistor active mixers-

a) are very expensive.

b) are difficult to manufacture.

c) exhibit a conversion gain.

d) exhibit a conversion loss.

---

33. The passive diode type of mixers-

a) are very expensive because of the diodes.

b) are only a theoretical concept.

c) exhibit a conversion gain.

d) exhibit a conversion loss.

34. Fig.6 shows part of a superheterodyne receiver which tunes over the band 550 - 1500kHz. With the local oscillator frequency set above the signal frequency, what will be the minimum and maximum frequency that the oscillator will be required to tune? Note, the IF is 465kHz.

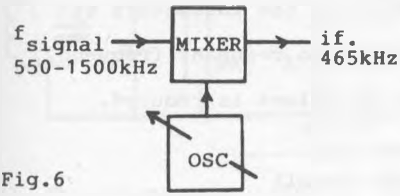


Fig.6

a) 550 - 1500kHz.

b) 465 - 1465kHz

c) 1015 - 1965kHz

d) 3 - 30MHz

---

35. Referring to Q34. The oscillator tuning ratio is-

a) 2•7:1 b) 3•15:1 c) 1•94:1 d) 12•2:1

---

36. Referring to Q34. If the local oscillator is set below the signal frequency, what minimum and maximum frequency would the oscillator be required to tune?

a) 85 - 1035kHz b) 3 - 30MHz

c) 1015 - 1965kHz d) 465 - 1465kHz

---

37. Referring to Q36. The oscillator tuning ratio is-

a) 2•7:1 b) 3•15:1 c) 1•94:1 d) 12•2:1

---

38. The superheterodyne local oscillator is usually higher than the signal frequency because-

a) it has been standard practice since the treaty of Versailles was signed in 1919.

b) the local oscillator voltage increases with frequency.

c) the lower frequencies interfere with hi-fi systems.

d) the tuned circuits are easier to design and track with a lower minimum to maximum frequency ratio.

39. Referring to fig.7. The trimming and padding capacitors are provided to ensure that-

a) high voltage flashover does not occur.

b) the resonant points of the oscillator and RF circuits are maintained at a constant frequency difference.

c) the effects of dampness and mould on the insulators of the tuned circuit does not change the resonant frequency.

d) electrical stress due to high 'Q' values is reduced.

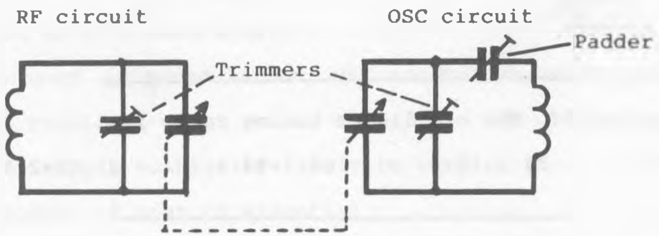


Fig.7

---

40. Receiver oscillators must exhibit good frequency stability, oscillators employing L C tuned circuits should have voltage stabilized supply rails, and the tuned circuits must be mechanically rigid and stable, also the tuned circuits and the other components should-

a) conform to BS 800.

b) be kept free from temperature changes.

c) be as large as possible.

d) be free from all soldered joints.

---

41. Which one of the following types of oscillator is likely to have the best frequency stability.

a) Colpitts. b) Hartley.

c) Clapp. d) Quartz crystal.

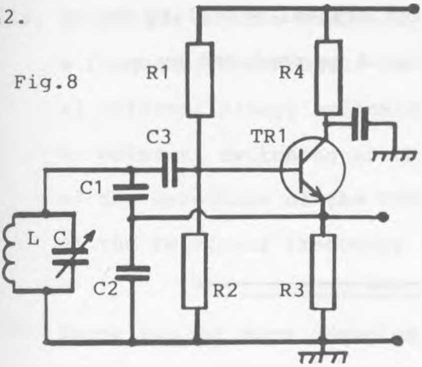
42. 

Fig.8 shows the circuit of a-

a) Colpitts oscillator.

b) Hartley oscillator.

c) Franklin master oscillator.

d) Common emitter amplifier.

---

43. The change in internal capacitance of a transistor due to temperature changes will cause the oscillator to drift, this effect can be minimised by swamping the internal capacitance of the transistor shown in fig.8 with components-

a) C1 and C2. b) R1 and R2.

c) C3. d) R3 and R4.

---

44. When a communication receiver is required to tune to a few spot frequencies only, the variable frequency oscillator can be replaced by a-

a) field effect transistor.

b) cavity tuned oscillator.

c) variable inductance tuned oscillator.

d) crystal controlled oscillator, a crystal for each frequency.

---

45. Referring to Q44. Additional frequency stability for this type of oscillator will be gained by-

a) selecting a FET with a high gain.

b) silver plating the cavity.

c) using gold plated wire for the inductor.

d) enclosing the crystal in a temperature controlled oven.

46. Where multi-channel operation with crystal stability is required, the local oscillator could be replaced by a-

a) moving coil oscillator.

b) frequency synthesizer.

c) harmonic generator.

d) cavity oscillator.

47.

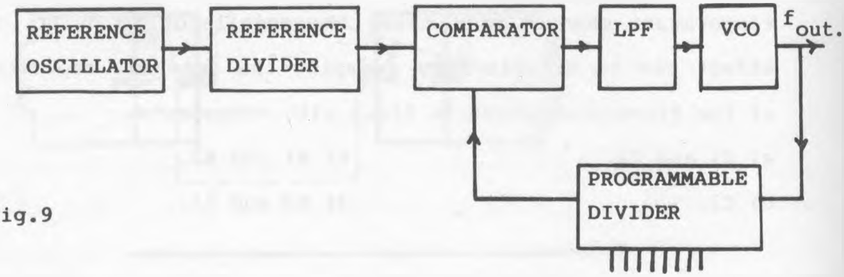


Fig.9

Fig.9 shows the block diagram of a frequency synthesizer. What is the VCO?

a) A variable carrier oscillator.

b) A voltage controlled oscillator.

c) A voltage coupled oscillator.

d) A versatile control oscillator.

---

48. The output frequency of the frequency synthesizer shown in fig.9, is changed by-

a) an external manual control on the VCO.

b) internal switching in the low pass filter (LPF).

c) changing the binary code on the programmable divider.

d) internal binary switching within the VCO.

49. Selection of the frequency step size, or channel spacing of a frequency synthesizer is determined by-

a) internal binary switching within the VCO.

b) external switching at the low pass filter (LPF).

c) the waveshape of the VCO output.

d) the reference frequency at the comparator input.

---

50. There can be many unwanted frequencies present at the output of a mixer stage. How does the IF amplifier discriminate against them?

a) By rejecting signals outside its passband.

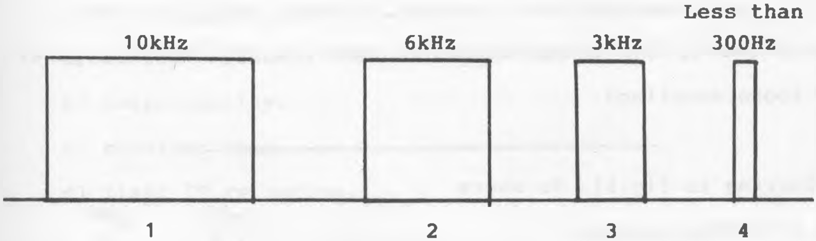
b) By only passing the audio frequencies.

c) By exploiting the AGC circuitry.

d) It doesn't, the rejection is in the AF amplifier.

---

51. Shown below are four ideal receiver bandpass characteristics. Match the type of received transmission to the most suitable bandwidth.



a)	b)	c)	d)
1 AM b'cast.	1 CW.	1 SSB speech	1 AM speech.
2 AM speech.	2 AM b'cast.	2 CW.	2 SSB speech.
3 SSB speech.	3 AM speech.	3 AM b'cast.	3 CW.
4 CW.	4 SSB speech.	4 AM speech.	4 AM b'cast.

52. The selectivity of the IF amplifier is determined by the-

a) design of the IF transformers and filters.

b) bandwidth of the RF stages.

c) noise generated in the mixer stage.

d) bandwidth of the beat frequency oscillator (BFO).

---

53. Fig.10a shows a typical IF transformer with a pair of mutually coupled tuned circuits, varying the degree of coupling produces the response characteristics shown in fig.10b below.

Which one of the characteristics is typical of tight coupling?

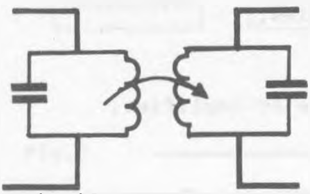


Fig.10a

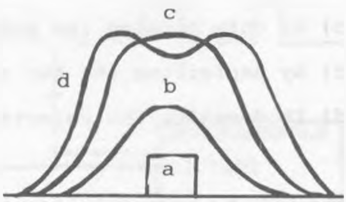


Fig.10b

---

54. Which one of the characteristics shown in fig.10b is typical of critical coupling?

---

55. Which one of the characteristics shown in fig.10b is typical of loose coupling?

---

56. Referring to fig.11. To where in a receiver circuit is point 'X' likely to be connected?

a) The local oscillator.

b) The AGC line.

c) The audio output.

d) The VCO.

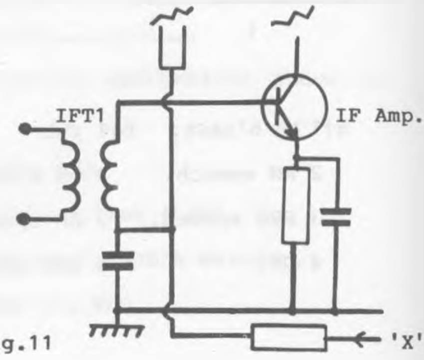
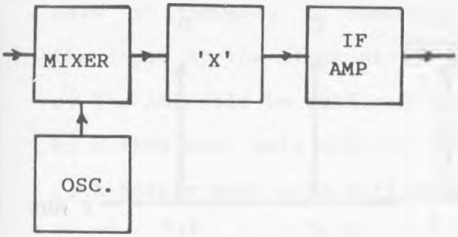


Fig.11

57.



You are told that block 'X' has been included after the mixer stage to improve the receiver selectivity.

What is it?

a) A high pass filter.

b) A low pass filter.

c) An IF preamplifier.

d) An IF crystal filter.

---

58. If a HF receiver has a fairly wide RF bandwidth, and a low IF, of 500kHz, it is likely that it will suffer from-

a) image, or second channel interference.

b) severe frequency modulation distortion.

c) audio regeneration in the mixer stage.

d) severe overloading in the AGC amplifier.

---

59. The problem encountered in Q58 is overcome in the double superheterodyne receiver by employing two stages of frequency conversion. The first IF is high, this improves the-

a) image, or second channel rejection.

b) audio quality.

c) receiver gain.

d) first IF rejection.

---

60. The second IF is lower than the first, this stage provides most of the-

a) receivers gain and adjacent channel selectivity.

b) audio frequency gain.

c) image, or second channel rejection.

d) linearity of the audio output.

61.

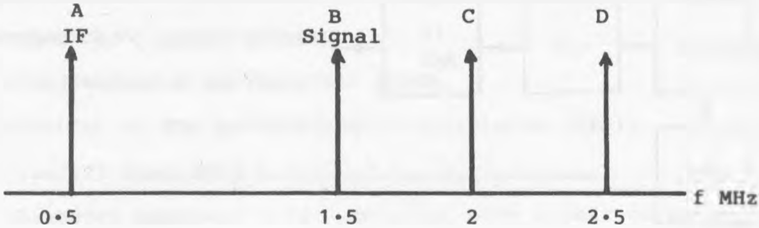


Fig.13

Fig.13 shows the typical spectrum of various signals associated with a superhet receiver. The IF is 500kHz, the received signal is 1·5MHz. What is signal 'C' in the spectrum?

a) The intermediate frequency.

b) The local oscillator.

c) The image, or second channel.

d) The carrier insertion oscillator.

---

62. Referring to fig.13. What is signal 'D' in the spectrum?

a) The intermediate frequency.

b) The local oscillator.

c) The image, or second channel.

d) The carrier insertion oscillator.

63.

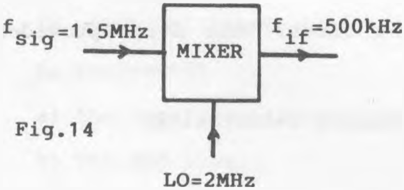


Fig.14

Fig.14 represents the mixer stage of a superhet receiver which is tuned to receive a signal on 1·5MHz. The image frequency, $f_{sig}+2IF$ will be-

a) 2MHz b) 2·5MHz

c) 3·5MHz d) 4MHz

64. A receiver with an IF of 500kHz is tuned to a wanted carrier wave of 1500kHz. An unwanted signal of 1501kHz appears at the input to the mixer stage. What will result?

a) The AGC will be rendered inoperative.

b) A 1kHz beat note will be heard at the audio output.

c) A 501kHz beat note will be heard at the audio output.

d) There will be no audio output.

65.

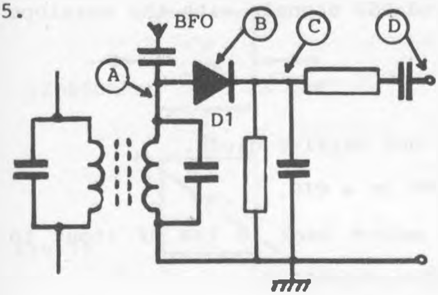


Fig.15

The detector circuit shown in fig.15 is for detecting AM signals. It is usually referred to as-

a) an envelope detector.

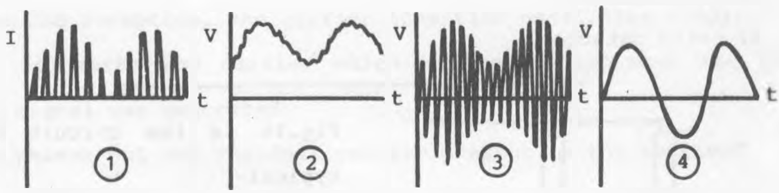
b) a product detector.

c) a discriminator.

d) a ratio detector.

---

66. At which points, A to D in the circuit shown in fig.15 would you expect the following waveforms?



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

67. Referring to the envelope detector shown in fig.15. Is it possible to receive a frequency modulated signal?

a) No.

b) Yes, but only if D1 is a silicon diode.

c) Yes, by setting the local oscillator lower than the signal.

d) Yes, by tuning the received signal halfway down the IF response curve. (Slope detection).

---

68. Is it possible to receive CW and SSB signals with the envelope detector shown in fig.15?

a) No.

b) Yes, By replacing D1 with a hot carrier diode.

c) Yes, by the addition of a BFO or a CIO.

d) Yes, by feeding the audio output back to the RF input to produce a form of degenerative detection.

---

69. The type of detector that one would normally associate with resolving CW and SSB signals is the-

a) envelope detector.

b) product detector.

c) discriminator.

d) ratio detector.

70.

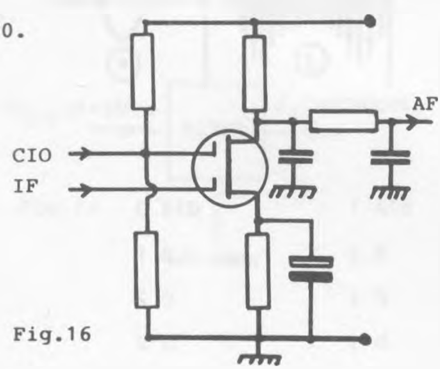


Fig.16

Fig.16 is the circuit of a typical-

a) dual gate MOSFET CW/SSB product detector.

b) dual gate MOSFET audio amplifier for SSB use.

c) receiver first mixer stage.

d) CW/SSB AGC amplifier.

71. When receiving a CW signal, the BFO is usually adjusted by the operator to produce an audible beat note, or tone, at the detector output of about-

a) 800 - 2000Hz.

b) 2000 - 2500kHz.

c) 500 - 2000kHz.

d) 2000 - 4500Hz.

72.

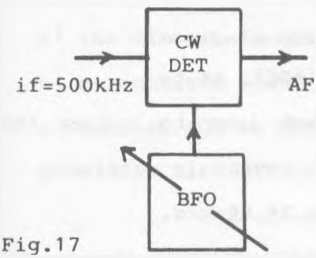


Fig.17

A suitable BFO frequency for the circuit shown in fig.17 would be-

a) 500kHz±10Hz.

b) 1MHz±3kHz.

c) 465kHz.

d) 500±3kHz.

---

73. The required BFO frequency to produce a 1kHz beat note at the audio output of fig.17 is-

a) 499 or 501kHz.

b) 49·9 or 50·1kHz.

c) 9 or 11kHz.

d) 1Hz.

---

74. For SSB reception, the carrier insertion oscillator (CIO)-

a) reinserts the carrier which was suppressed when the SSB signal was generated.

b) phases-out any residual carrier present on the received transmission.

c) is used to hold the AGC at a constant level.

d) is used for automatic frequency locking.

75. Part of the overall improvement gained by the use of an SSB system is due to-

a) the reduced receiver bandwidth of approx: 300-2500Hz, which improves the signal/noise ratio.

b) the increased receiver bandwidth of approx: 6kHz, which gives a lower signal/noise ratio.

c) the reduced receiver bandwidth which reduces the signal/-noise ratio by 20dB.

d) the noise cancelling properties of the product detector.

---

76. The purpose of automatic gain control (AGC), is to-

a) provide an audio frequency feedback loop to reduce the gain of the output stage when a weak signal is received.

b) maintain constant selectivity in the IF stages.

c) ensure a constant frequency separation between the signal and the local oscillator.

d) maintain a reasonably constant audio output level when RF signals of varying amplitude are received.

---

77. The basis of operation of a simple AGC system is that as the received signal level increases,-

a) a signal is fed back to the local oscillator which reduces the oscillator output level.

b) the output of the AGC detector increases, and is fed back to the early stages of the receiver in such a way that it will reduce the receiver RF and IF gain.

c) the output of the AGC detector increases the d.c. bias in the IF coils, lowering the 'Q' and hence the gain of the IF amplifier stages.

d) the gain of the BFO decreases, reducing the audio output.

78. One of the problems of a simple AGC circuit is that-

a) it is difficult to adjust.

b) the AGC voltage will interact with the d.c. power supply voltage, reducing the efficiency of the receiver.

c) even weak signals will cause a reduction in the receiver gain and output level.

d) the AGC diodes fail when strong signals are received.

---

79. To overcome the problem referred to in Q78 above,-

a) the circuit is made self regulating.

b) a regulated power supply is used.

c) delayed AGC is employed.

d) diodes with a higher PIV are used.

---

80. Delayed AGC-

a) has a delay time of 75ms.

b) has an attack time of 1s.

c) does not start to reduce the gain of the receiver until the RF signal has reached a predetermined level.

d) must have the same time constant as the detector.

---

81. Fig.18 shows the circuit of a-

a) Foster Seeley FM discriminator.

b) wideband SSB detector.

c) narrow band CW/SSB detector.

d) linear DSB detector.

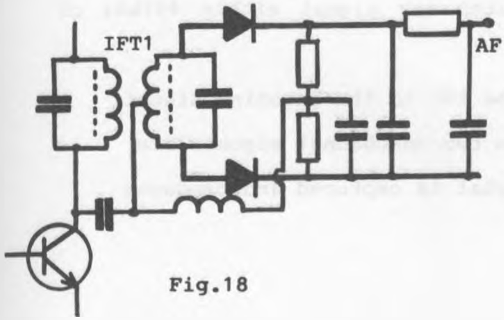


Fig.18

82. Referring to fig.18. Both tuned circuits are resonant at the same frequency. What controls the bandwidth over which the circuit operates?

a) Amplitude variations on the received FM signal.

b) The coupling between the primary and the secondary windings of the transformer, and also the 'Q' factors of the tuned circuits.

c) The deviation of the received signal.

d) The deviation of the transmitted signal.

---

83. When a receiver is used for the reception of narrow band frequency modulated signals (NBFM), the detector should normally be preceded by-

a) an AGC circuit to reduce the level of the received signal.

b) a double balanced mixer stage.

c) an audio low pass filter.

d) a limiter stage, to remove amplitude variations from the received signal.

---

84. The term 'capture effect' is very often used when talking about FM receivers. Capture effect is-

a) a disadvantage, it captures more carrier than modulation.

b) a disadvantage, it captures any signal within 405kHz of the wanted signal.

c) an advantage, its locks the AGC to the incoming signal.

d) an advantage, because when two co-channel signals are present, the strongest signal is captured and produces the audio output.

85. The presence of strong unwanted signals at any non-linear stage of a receiver can cause-

a) modulation hum in the loudspeaker.

b) cross-modulation, intermodulation and blocking.

c) a.c. to d.c. conversion in the BFO of the receiver.

d) a large change in the resonant point of the RF and mixer tuned circuits of the receiver.

---

86. The audio stage of a communication receiver requires-

a) an audio bandwidth of 300-3000Hz, and an output power of about 1 to 2 Watts.

b) a 15kHz bandwidth, and a power output of 15 Watts.

c) a 200kHz bandwidth, and a power output of 25 Watts.

d) a flat frequency response of 10-25,000Hz, and a power output of 10 Watts into a 600 Ohm load.

---

12. RADIO RECEIVERS

1	c	26	c	51	a	76	d
2	a	27	b	52	a	77	b
3	d	28	a	53	d	78	c
4	b	29	c	54	c	79	c
5	c	30	b	55	b	80	c
6	a	31	a	56	b	81	a
7	a	32	c	57	d	82	b
8	b	33	d	58	a	83	d
9	d	34	c	59	a	84	d
10	d	35	c	60	a	85	b
11	c	36	a	61	b	86	a
12	b	37	d	62	c		
13	d	38	d	63	b		
14	d	39	b	64	b		
15	c	40	b	65	a		
16	c	41	d	66	d		
17	a	42	a	67	d		
18	d	43	a	68	c		
19	c	44	d	69	b		
20	a	45	d	70	a		
21	b	46	b	71	a		
22	b	47	b	72	d		
23	d	48	c	73	a		
24	c	49	d	74	a		
25	d	50	a	75	a		

[illegible]

13. RADIO TRANSMITTERS

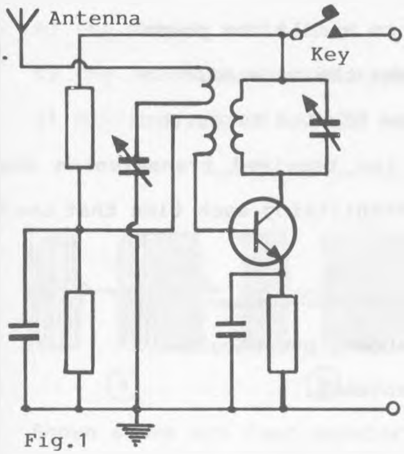
1. 

Fig.1

Fig.1 shows the diagram of a transmitter in its most basic form, what is its main problem?

a) Pulling of the oscillator frequency by the antenna loading.

b) Suitable transistors are not available.

c) Suitable high impedance antennas are not available.

d) Insufficient feedback.

---

2. The problem mentioned in Q 1 above is overcome by-

   a) following the oscillator with a buffer amplifier.

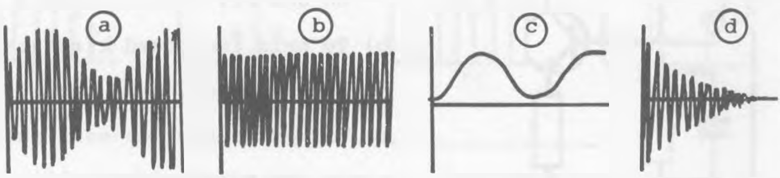
   b) using a Darlington pair transistor configuration.

   c) using a Yagi antenna.

   d) increasing the feedback.

---

3. Referring to fig.1. With the key closed, which one of the waveforms below represents the transmitter output?



---

4. The transmitter shown in fig.1 is capable of sending-

   a) A.M. speech only (A3E). b) F.M. speech only (F3E).

   c) C.W. telegraphy (A1A). d) all three of the above.

---

5. If the basic transmitter as shown in fig.1, is used for sending CW, another problem is that-

a) the antenna will not be able to handle the power.

b) it will not be possible to tune the antenna.

c) the R.F. output signal will be shunted to earth.

d) there might be a chirp on the received transmission due to the oscillator frequency stabilizing each time that the transmitter is keyed.

---

6. To overcome the problem of Q 5 above, one should-

a) use very thick wire for the antenna.

b) use a good ATU.

c) keep the antenna well clear of the ground.

d) avoid keying the oscillator directly.

7.

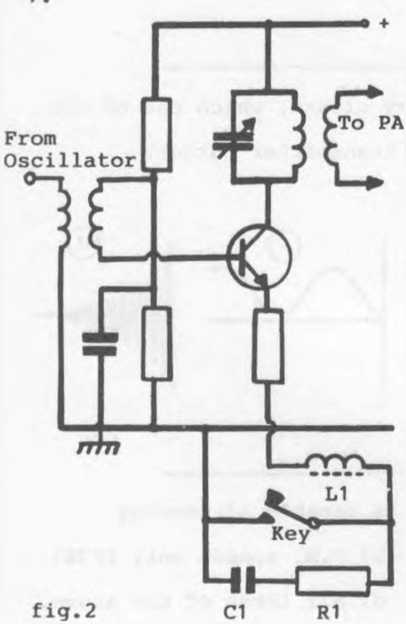


fig.2

Fig.2 shows the circuit of a keyed buffer amplifier to follow the basic circuit of fig.1. What are components C1,R1 and L1 for?

a) To allow the transistor to turn on and off more rapidly.

b) To hold the tuned circuits on frequency.

c) To reduce the resonant current in the tuned circuit.

d) They form the 'key click filter' to prevent interference being transmitted.

8. Referring to fig.2. Without components C1, R1 and L1-

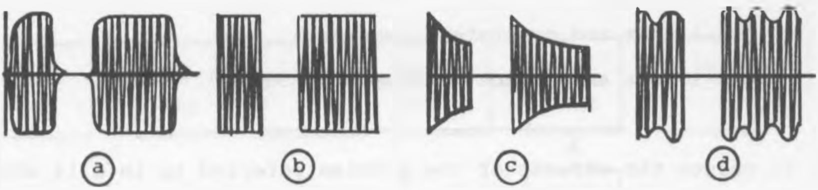
a) the transistor might fail.

b) the output would vary in level.

c) the resonant circuit might overheat.

d) spurious signals could be radiated over a wide band.

9.



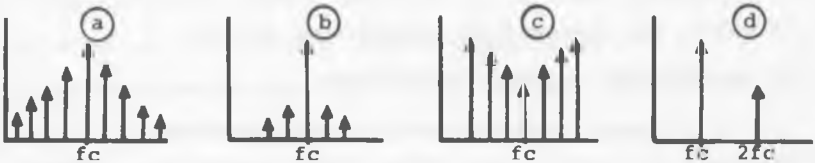
Shown above are four waveforms, which one is typical of that from a CW transmitter with an unsuppressed key?

---

10. Which one of the above waveforms is typical of a CW transmitter using a suppressed key?

---

11. Referring to the frequency spectrum diagrams shown below, which one might you see if you were using an unsuppressed key?



---

12. Referring to the frequency spectrum diagrams above, which one might you expect to see when the key is suppressed?

13. For the greatest efficiency, a CW transmitter will be operated in class-

a) A b) AB c) B d) C

---

14. Class C amplifier stages are-

a) linear and do not generate harmonics.

b) linear and generate harmonics.

c) non-linear and generate harmonics.

d) non-linear and do not generate harmonics.

---

15. To reduce the effects of the problem referred to in Q 14 above, the antenna should be-

a) connected directly to the PA stage.

b) coupled to the oscillator stage.

c) connected to the PA stage via a low pass filter.

d) coupled to the power supply smoothing choke.

---

16. One purpose of the carrier wave is to-

a) transfer the power from the battery to the antenna.

b) position the transmitted signal in the RF spectrum.

c) reduce the transmitted interference levels.

d) prevent the PA stage overheating.

---

17. How does the carrier wave convey intelligence, e.g. speech?

a) By its absence.

b) By its presence.

c) By a process called modulation.

d) By a process called regeneration.

18. On-off keying is a form of modulation, select the list below which names three other forms of modulation.

a)	b)	c)	d)
Heaviside	Reactance	Phase	Cross polar
Appleton	Resonance	Frequency	Rhombic
Rayleigh	Impedance	Amplitude	Phase delay

19.

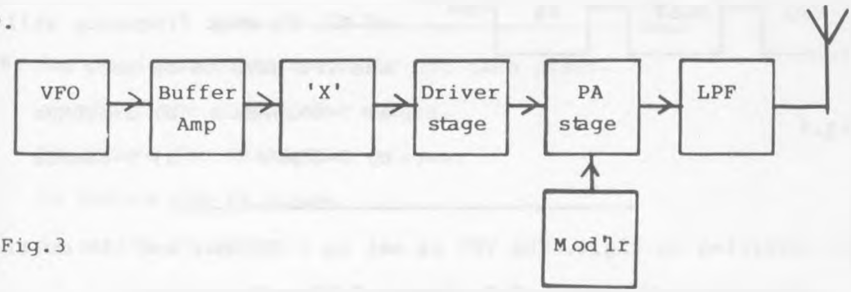


Fig.3

Fig.3 above shows the block diagram of an amplitude modulated (AM) transmitter, it is possible to cover a number of amateur HF bands from a single VFO operating over a narrow frequency band, say 1·6 - 2·0MHz, and following it with one or more stages of box 'X'. What is box 'X'?

a) An additional buffer amplifier to increase linearity.

b) A set of intermediate frequency amplifiers.

c) Frequency multiplier stages, or harmonic amplifiers.

d) A selective bandpass filter to prevent harmonics.

---

20. Frequency multiplier stages are normally operated in class C in order to-

a) obtain a very linear output signal.

b) operate over the linear portion of the transfer curve.

c) produce an output which is rich in harmonics.

d) produce an output that is frequency stable.

21. The multiplication factor of a frequency multiplier stage is usually about X2 or X3, therefore when high multiplication factors are required, several stages are employed. Referring to fig.4, an output frequency of 29MHz is required and the multiplication is in 4 stages of X2. To what frequency will the VFO have to be set?

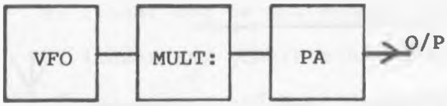


Fig.4

a) 1•8125MHz   b) 3•625MHz

c) 7•25MHz   d) 9•666MHz

---

22. Referring to fig.4. The VFO is set to 1•7875MHz and the multiplier chain consists of 3 stages of X2 multiplication. What is the output frequency?

a) 1•7875MHz   b) 3•575MHz   c) 14•3MHz   d) 28•6MHz

---

23. Why, in a multiplier stage are multiplication factors above X3, or X5 at the most, not normally used? Because-

a) the higher order harmonics cause more interference.

b) the higher order harmonics cause excessive power drain.

c) the higher order harmonics are liable to drift independently.

d) the harmonic power reduces as the harmonic number increases.

---

24. Transmitter VFO's, or carrier generation oscillators must have a high order of frequency stability to ensure that-

a) the multiplier stages do not detune.

b) the multiplier stages do not generate 7^{th} order harmonics.

c) the amplitude of the output signal does not vary.

d) the transmitted signal does not drift outside its allocated frequency band.

25. In a circuit employing multiplier stages, any drift at the VFO or carrier oscillator will be-

a) cancelled in the multiplier chain.

b) decreased by the multiplication factor.

c) increased by the multiplication factor.

d) increased by 4 times the multiplication factor.

---

26. Amplitude modulation should not take place-

a) after the multiplier stages.

b) before the multiplier stages.

c) before the PA stage.

d) at the PA stage.

27.

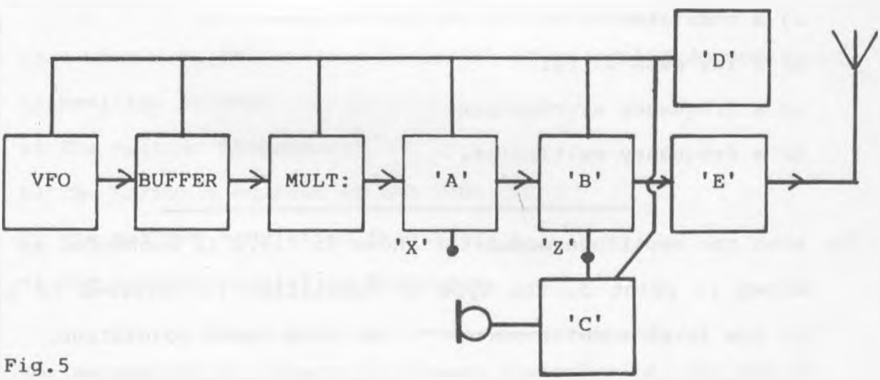


Fig.5

Fig.5 shows the block diagram of a typical amplituded modulated transmitter. What is box 'A'?

a) Driver stage. b) Modulator.

c) Power supply unit. d) High pass filter.

---

28. Referring to fig.5. What is box 'B'?

a) Driver stage. b) Modulator.

c) PA stage. d) Low pass filter.

29. What is box 'C' in fig.5?

a) Modulator.
b) Low pass filter.
c) Power supply unit.
d) Multiplier.

---

30. What is box 'D' in fig.5?

a) P.A. stage.
b) Low pass filter.
c) Multiplier.
d) Power supply unit.

---

31. What is box 'E' in fig.5?

a) P.A. stage.
b) Low pass filter.
c) Multiplier.
d) Feedback stage.

---

32. If a transmitter is required to transmit speech it will need-

a) a modulator.
b) a low pass filter.
c) a frequency synthesiser.
d) a frequency multiplier.

---

33. When the amplitude modulator shown in fig.5 is connected as shown to point Z, the type of modulation is referred to as-

a) low level modulation.
b) high level modulation.
c) frequency modulation.
d) antenna modulation.

---

34. When the amplitude modulator shown in fig.5 is connected to point X, the type of modulation is referred to as-

a) low level modulation.
b) high level modulation.
c) frequency modulation.
d) split level modulation.

35. Why is a buffer amplifier used in the circuit of fig.5?

a) To prevent oscillator load changes pulling the oscillator off frequency.

b) To prevent parasitic oscillations generated in the oscillator reaching the P.A. stage.

c) To prevent parasitic oscillations in the multiplier stages.

d) To reduce the harmonic content of the oscillator output.

---

36. The process of modulation generates-

a) odd harmonics.

b) sub harmonics.

c) phase-locked harmonics.

d) sidebands.

---

37. Upon what does the maximum bandwidth of an amplitude modulated transmitter depend?

a) The carrier frequency.

b) The harmonic content of the VFO.

c) The maximum modulating frequency.

d) The minimum modulating frequency.

---

38. For an amateur or commercial speech transmission, the speech frequencies need only be in the range-

a) 3 - 300Hz　　b) 30 - 300Hz

c) 300 - 3000Hz　　d) 1200 - 3300Hz

---

39. The broadcast transmission of music requires-

a) a very narrow bandwidth.

b) a wider bandwidth than commercial speech.

c) the whole R.F. spectrum.

d) no bandwidth at all.

40. Why should the band width of a transmission be restricted to that necessary for acceptable speech quality only?

a) To ensure spectrum efficiency.

b) To save transmitter power.

c) To prevent animals and birds being disturbed by the high frequency audio waves. (RSPCA regulation No 22).

d) To save on receiver filter costs.

---

41. A 1MHz carrier wave is amplitude modulated by an audio speech signal of 300 - 3000Hz, the transmitted signal consists of-

a) a carrier wave displaced by 3000Hz.

b) two carrier waves, one at 997kHz and one at 1003kHz.

c) a carrier wave and two sidebands, total bandwidth 3kHz.

d) a carrier wave and two sidebands, total bandwidth 6kHz.

---

42. Fig.6

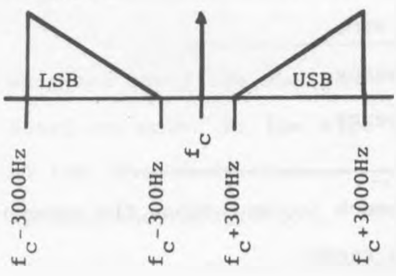


Fig.6 shows the R.F. spectrum of the amplitude modulated wave referred to in Q 41 above, the upper sideband (USB) is termed the erect sideband,why is the lower sideband (LSB) termed the inverted sideband? Because-

a) its frequency is below the carrier frequency.

b) it is the last sideband generated during modulation.

c) the carrier frequency is higher than the lower sideband.

d) this sideband places the highest modulating frequency lowest in the R.F. spectrum.

43. What precautions should be taken to restrict the bandwidth of a transmission to the minimum necessary for the transmission of acceptable quality speech signals only?

a) Use only the minimum power necessary for the contact.

b) Fit an audio high pass filter in the modulator stage.

c) The modulator stage should contain an audio low pass filter.

d) An electret microphone should be used.

44.

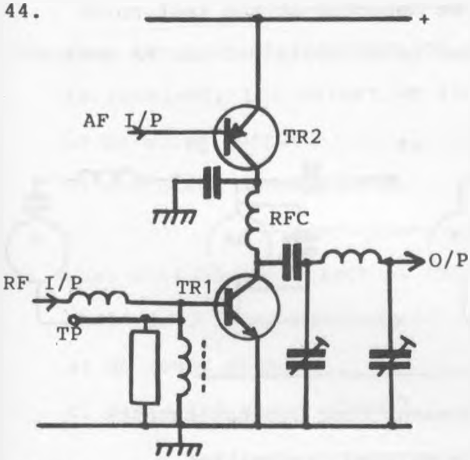


Fig.7

Fig.7 shows the circuit of a-

a) frequency modulated output stage for a VHF transmitter.

b) phase modulated transmitter output stage.

c) plate modulated transmitter filter stage.

d) amplitude modulated transmitter output stage.

---

45. Referring to fig.7. What class of bias should TR1 be operated in for modulation to take place with maximum efficiency?

a) Class A. b) Class AB. c) Class B. d) Class C.

---

46. When an amplitude modulated signal has been generated all subsequent stages of amplification should be-

a) linear. b) non-linear. c) wideband. d) narrowband.

---

47. Referring to fig.7. The modulator transistor TR2 should be operated in a class of bias which is -

a) linear. b) non-linear. c) wideband. d) narrow band.

48. For 100% modulation, the power supplied by the modulator must be-

a) equal to the carrier power.

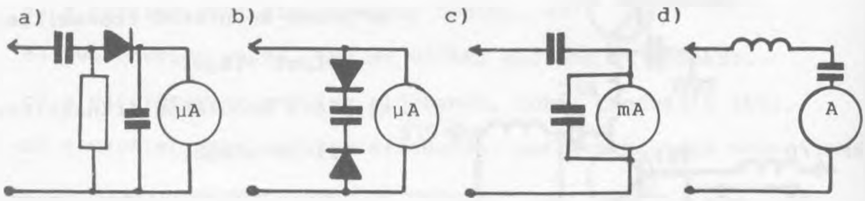
b) twice the carrier power.

c) half of the carrier power.

d) one third of the carrier power.

---

49. Referring to fig.7. When maximum R.F. drive is being supplied to the PA stage, a peak will be detected at the test point TP, which of the circuits shown below would you use to detect this peek?



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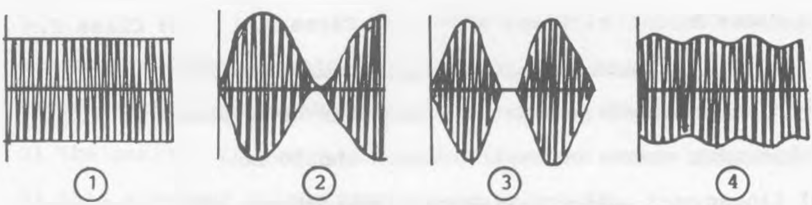
50. The waveforms shown below represent four typical output conditions from an amplitude modulated transmitter, waveform 1 shows-

a) carrier wave only.

b) low modulation.

c) 100% modulation.

d) over-modulation



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51. Referring to the above waveforms, waveform 2 shows-

a) carrier wave only.

b) low modulation.

c) 100% modulation.

d) over-modulation.

52. Referring to the waveforms shown in Q 50, waveform 3 is representative of-

a) carrier wave only. b) low modulation.

c) 100% modulation. d) over-modulation.

---

53. Waveform 4, Q 50 is typical of-

a) carrier wave only. b) low modulation.

c) 100% modulation. d) over-modulation

---

54. When the type of transmission shown in Q 50 as waveform 3 is received, the effect at the receiver will most likely be-

a) no sound output. b) loud sound output.

c) distorted sound output. d) low sound output.

---

55. What will be the effect at the receiver of receiving a signal shown in Q 50 as waveform 4?

a) No sound output. b) Loud sound output.

c) Distorted sound output. d) Low sound output.

---

56. Overmodulation is likely to result in-

a) odd harmonic interference. b) even harmonic interference.

c) sideband splatter. d) faulty coupling.

---

57. An overdriven PA stage is likely to-

a) burn out the antenna. b) fuse the low pass filter.

c) generate harmonics. d) detune the VFO.

58. Referring to the spectrum of the AM wave, fig.6, how is it possible to communicate with half the transmitted bandwidth and save on transmitter power?

a) By shifting the carrier frequency in sympathy with the speech wave.

b) By suppressing the carrier wave.

c) By suppressing the carrier wave and one sideband.

d) By suppressing the sidebands and transmitting only the carrier wave.

---

59. Referring to Q 58. What is this type of transmission called?

a) Narrow band frequency modulation (NBFM).

b) Double sideband suppressed carrier (DSBSC).

c) Single sideband suppressed carrier (SSBSC).

d) Carrier wave (CW).

60.

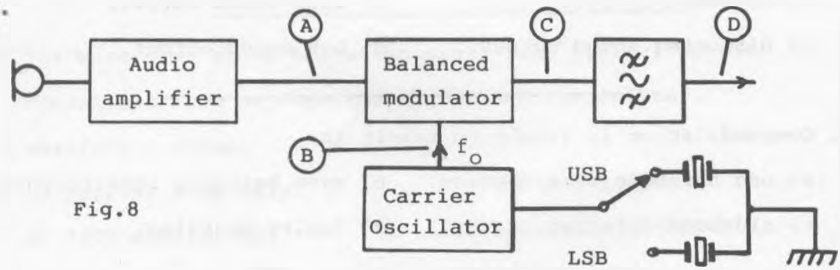


Fig.8

Fig.8 shows the block diagram of a typical-

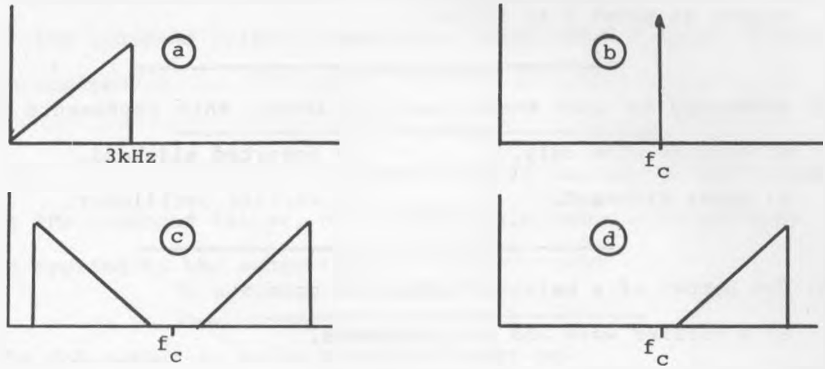
a) single sideband generator.

b) carrier wave generator.

c) NBFM modulator.

d) reactance modulator.

61.



Which of the frequency spectrum diagrams shown above would you expect at point A in fig.8?

62. Referring to your answer to Q 61 above, this represents the-

a) carrier oscillator . b) audio band of frequencies.

c) lower sideband. d) upper and lower sidebands.

63. Which of the frequency spectrum diagrams shown above in Q 61 would you expect at point B in fig.8?

64. Referring to your answer to Q 63 above, this represents the-

a) carrier oscillator. b) audio band of frequencies.

c) upper sideband. d) lower sideband.

65. Which of the frequency spectrum diagrams shown above in Q 61 would you expect at point C in fig.8?

66. Referring to your answer to Q 65 above, this represents the-

a) carrier oscillator. b) upper and lower sidebands.

c) carrier wave only. d) audio band of frequencies.

67. Which of the spectrum diagrams shown in Q 61 would you expect at point D in fig.8?

68. Referring to your answer to Q 67 above, this represents the-

a) carrier wave only. b) inverted sideband.

c) upper sideband. d) carrier oscillator.

69. The output of a balanced modulator consists of-

a) a carrier wave and two sidebands.

b) a carrier wave and one sideband.

c) a carrier wave only.

d) two sidebands only.

70. The filter at the output of the balanced modulator should-

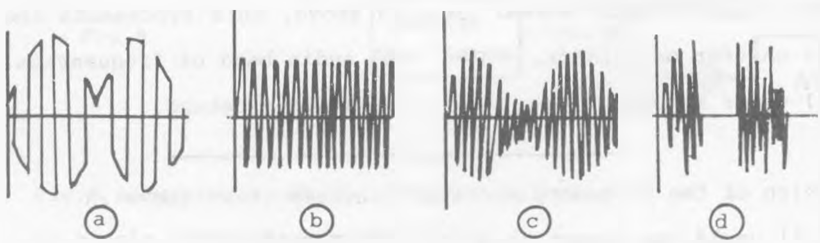
a) only be as wide as the speech bandwidth.

b) have a bandwidth at least five times the speech bandwidth.

c) attenuate the wanted sideband by at least 60dB.

d) be of the charcoal resonator type.

71.



Which of the waveforms shown above represent the output of the balanced modulator stage, point C in fig.8, with a single tone audio input applied?

72. Which one of the waveforms shown in Q 71 represents the output of the sideband filter, point D in fig.8, when a speech signal is applied?

---

73. Which one of the waveforms shown in Q 71 represents the output of the sideband filter, point D in fig.8, when a single tone is applied to the audio input?

---

74. The SSB output at point D in fig.8 must be-
    a) amplified in a frequency multiplier chain.
    b) amplified by linear stages only.
    c) mixed or heterodyned with other frequencies to reach its output frequency.
    d) both b and c above are correct answers.

---

75. The SSB output at point D in fig.8, once generated, should not be-
    a) passed through a frequency multiplier chain.
    b) amplified in linear stages.
    c) mixed or heterodyned with other frequencies to reach the final output frequency.
    d) mixed with frequencies above 10MHz.

---

76. Referring to fig.8. The method used to change from upper sideband to lower sideband is by-
    a) switching the oscillator frequency f_o.
    b) switching the sideband filter.
    c) reversing the spectrum of the modulating signal.
    d) phase-shifting the modulating signal.

77. What will a radio frequency power meter register when it is connected in the antenna feeder of a single sideband suppressed carrier transmitter, which has no audio input to the balanced modulator?

a) Nothing.

b) Full scale deflection.

c) Half scale deflection.

d) A pulsed deflection.

---

78. The overall power gain of a single sideband suppressed carrier radio system, compared with a DSB AM system is about-

a) 1dB b) 3dB c) 9dB d) 27dB

---

79. In the case of frequency modulation (FM), the carrier frequency change due to the modulating signal is termed-

a) modulation factor. b) modulation index.

c) deviation. d) bandwidth.

---

80. The term 'modulation index' used in connection with a frequency modulated wave is-

a) the ratio of the carrier frequency deviation 'df', to the frequency of the modulating wave, 'f_m'. i.e. df/f_m.

b) the ratio of the carrier frequency, 'f_c' to the frequency of the modulating wave,'f_m'. i.e. f_c/f_m.

c) twice the frequency deviation. 2df.

d) half the frequency deviation. df/2.

---

81. A carrier wave of 145MHz is frequency modulated with a 3kHz audio signal, and the resultant deviation is 2.5kHz. What is the modulation index?

a) 24·166 b) 5 c) 1·25 d) 0·833

82. The deviation of the carrier frequency of a frequency modulated wave is proportional to-

a) the frequency of the modulating wave.

b) the amplitude of the modulating wave, divided by four.

c) the instantaneous amplitude of the modulating wave.

d) the cost of the microphone used.

83.

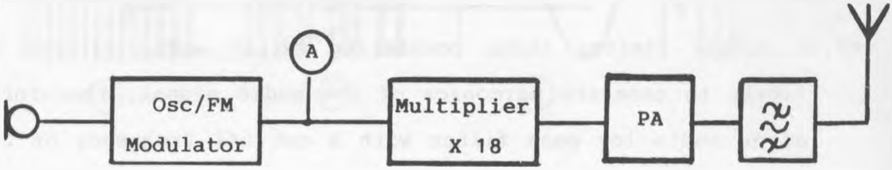


Fig.9

Fig.9 shows the block diagram of a typical VHF FM transmitter. If the required output frequency is 145MHz, on what frequency would you order the crystal for the oscillator?

a) 8•0555kHz b) 8•0555MHz c) 10•7MHz d) 27MHz

---

84. Referring to fig.9. The output frequency of the transmitter is required to have a frequency deviation of 2•5kHz, what will be the deviation at the modulator/oscillator output, point A?

a) 138•888Hz b) 138•888kHz c) 138•888MHz d) 9MHz

---

85. The practical bandwidth of a frequency modulated transmission is given by the formula $2(df + f_m)$. What transmission bandwidth is required for a VHF transmission when the frequency deviation is 2•5kHz and the highest modulating frequency is 3kHz?

a) 11kHz b) 8kHz c) 5•5kHz d) 4kHz

86. Why is it desirable to limit the peak amplitude of the audio signal applied to the frequency modulator?

a) To ensure that the harmonics of the signal are transmitted.

b) To save about 6dB in carrier power.

c) To ensure that single sidebands are not generated.

d) To maintain the carrier deviation within its prescribed limits.

---

87. A simple limiter stage consisting of an audio clipper is likely to generate harmonics of the audio signal, therefore-

a) an audio low pass filter with a cut off frequency of 2·5kHz to 3kHz is required at the clipper output.

b) a 'key click filter' must be fitted across the microphone.

c) at least three multiplier stages must follow.

d) a 12·5kHz band stop filter must be fitted after the limiter.

---

88. Fig.10 shows a circuit for direct frequency modulation. Why is the bias required?

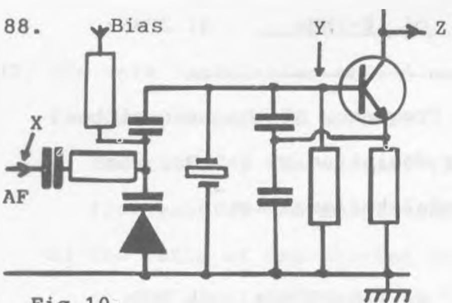


Fig.10

a) To maintain a high standing current through the varicap.

b) To power feed the microphone.

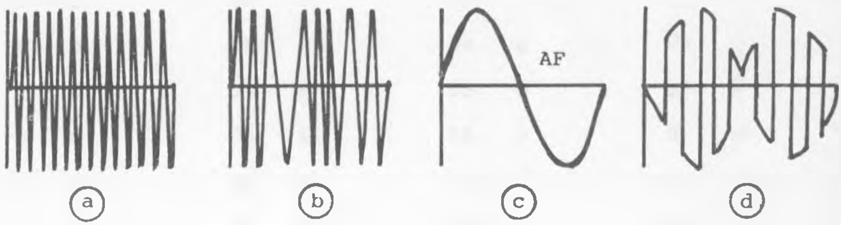
c) To bias the transistor to the linear portion of its transfer characteristic.

d) To enable the varicap diode to be operated over the linear part of its characteristic.

89. Once frequency modulation has taken place, all subsequent amplifier stages can be operated for maximum efficiency in-

a) class A b) class AB c) class B d) class C

90.



Referring to fig.10. Which one of the waveforms shown above would you expect to be present at point 'X' when an audio frequency tone is applied to the input?

91. Referring to fig.10. Which one of the waveforms shown in Q 90 might you expect at point 'Z' when an audio signal is applied to the input?

92. Referring to fig.10. Which one of the waveforms shown in Q 90 might you expect at point 'Y' with no audio input?

93. The carrier frequency power of a frequency modulated wave diminishes during modulation. Where does it go?

a) Into the power supply unit.

b) Into the side frequencies to be transmitted.

c) It is dissipated as heat in the crystal.

d) It is dissipated as heat in the power transistors.

13. RADIO TRANSMITTERS

1	a	26	b	51	c	76	a
2	a	27	a	52	d	77	a
3	b	28	c	53	b	78	c
4	c	29	a	54	c	79	c
5	d	30	d	55	d	80	a
6	d	31	b	56	c	81	d
7	d	32	a	57	c	82	c
8	d	33	b	58	c	83	b
9	b	34	a	59	c	84	a
10	a	35	a	60	a	85	a
11	a	36	d	61	a	86	d
12	b	37	c	62	b	87	a
13	d	38	c	63	b	88	d
14	c	39	b	64	a	89	d
15	c	40	a	65	c	90	c
16	b	41	d	66	b	91	b
17	c	42	d	67	d	92	a
18	c	43	c	68	c	93	b
19	c	44	d	69	d		
20	c	45	d	70	a		
21	a	46	a	71	a		
22	c	47	a	72	d		
23	d	48	c	73	b		
24	d	49	a	74	d		
25	c	50	a	75	a		

[illegible]

14. PROPAGATION

1. The ionosphere is a-

   a) ball of ionised gasses which form during thunderstorms.

   b) region of ionised gasses surrounding the earth.

   c) region of ionised gasses surrounding the sun.

   d) big sphere of iron, capable of reflecting radio waves.

---

2. The ionosphere-

   a) extends from about 50km to about 500km above the surface of the earth.

   b) is any expanse of water outside the U.K. territorial waters.

   c) surrounds the sun to a distance of exactly 3×10^8 metres.

   d) travels at a speed of 3×10^8 m/s.

---

3. What is the velocity of radio waves in free space?

   a) 470m/s. b) 625m/s. c) 3×10^6 m/s. d) 3×10^8 m/s.

---

4. Ionisation of the gas molecules in the earth's upper atmosphere is due to-

   a) U.V. radiation from the sun.

   b) small particles of moon dust, more dense in winter.

   c) evaporation of the oceans.

   d) the earth's temperature.

---

5. The height of the F1 layer above the earth's surface is approximately-

   a) 50km. b) 200km. c) 10km. d) 6km.

6. The height of the F2 layer is rather variable, but in general, during the winter months it is-

a) still higher than the F1 layer.

b) lower than the F1 layer.

c) lower than the E layer.

d) lower than the D layer.

---

7. What is the height of the F2 layer?

a) Exactly 100km above sea level.

b) 35,000km above mean sea level.

c) 22,000km above mean sea level.

d) Variable, between 300km and 400km.

---

8. How many F layers exist during daytime?

a) 1 b) 2 c) 3 d) 4

---

9. How many F layers exist at night?

a) 1 b) 2 c) 3 d) 4

---

10. Two of the ionised layers merge at night to form a single ionised layer, they are the-

a) D - E b) E - F1 c) F1 - F2 d) D - F1

---

11. At night the level of ionisation of the layers-

a) increases. b) decreases.

c) remains the same. d) fades to zero.

12. The principal mode of propagation for long distance (Dx) communication in the HF band is by-

a) ground wave. b) reflection from ionosphere.

c) direct wave. d) tropospheric reflection.

---

13. The principal mode of propagation for long distance (Dx) communication in the LF band is by-

a) ground wave. b) reflection from ionosphere.

c) direct wave. d) tropospheric reflection.

---

14. In which one of the following frequency bands is sky-wave propagation the principal mode of propagation?

a) LF b) MF c) HF d) VHF

---

15. The height of the E layer is approximately-

a) 250 - 400km b) 200 - 250km

c) 100 - 140km d) 50 - 90km

---

16. What happens to the E layer at night?

a) It disappears.

b) It remains, but rather weakly ionised.

c) It remains, but with increased density.

d) It drops below the horizon.

---

17. The maximum reflecting properties of the E layer occur around-

a) midday. b) midnight.

c) early morning. d) early evening.

18. In winter the E layer-

a) remains at about the same height as in summer.

b) increases in height.

c) decreases in height.

d) deionises completely.

---

19. The D layer is ionised-

a) during the hours of darkness.

b) during daylight hours.

c) at all times.

d) in summer only.

---

20. What happens to the D layer at night?

a) It becomes heavily ionised.

b) It deionises and disappears.

c) It remains the same as in daytime.

d) It drops below the troposphere.

---

21. What is the approximate height of the D layer?

a) 250 - 400km.

b) 200 - 250km.

c) 100 - 140km.

d) 50 - 90km.

---

22. In which one of the following frequency bands is sky-wave propagation the accepted mode?

a) 30 - 300kHz.

b) 300 - 3000kHz.

c) 3 - 30MHz.

d) 300 - 3000MHz.

23. The frequencies used for transcontinental transmission at night are-

a) generally higher than those used during the day.

b) generally lower than those used during the day.

c) very much higher than those used during the day.

d) normally the same as those used during the day.

---

24. To maintain a long distance sky-wave transmission at night, it is necessary to-

a) increase the working frequency.

b) decrease the working frequency.

c) decrease the transmitter power.

d) switch to frequency modulation.

---

25. To achieve the greatest skip distances,-

a) the sun must shine.

b) it must be noon at Greenwich.

c) the take-off angle of the radio wave must be low.

d) it should be winter below the point of reflection.

---

26. You are in contact with a few Russian stations during the day on a frequency of 21MHz, but when night falls you find that you have to change frequency (QSY) to 14MHz or even 7MHz to maintain contact. What is the reason for this?

a) There is no reason, it has become accepted practice.

b) Tidal variations cause the signal take-off angles to vary.

c) The ionised layers are less densely ionised at night and the higher frequencies pass through into space.

d) Severe absorption in the actual Iron Curtain causes the waves to be attenuated 60dB below normal.

27. What are the designated frequencies for the following bands? Enter them below.

a) MF. __________

b) HF. __________

c) VHF. __________

d) UHF. __________

---

28. Eruptions on the surface of the sun are often referred to as-

a) Volcanoes.

b) Black holes.

c) Cathodic eruptions.

d) Solar flares.

---

29. One of the causes of fading on long distance HF links is due to-

a) ionospheric storms.

b) thunder storms along the skip route.

c) heavy rain along the skip route.

d) none of the above.

---

30. Regular variations occur in the ionosphere, daily, seasonally, and also-

a) in phase with the equatorial thunderstorm season.

b) at civil airline flight busy hours.

c) with the 11 year sunspot cycle.

d) with the mean moon temperature maxima.

---

31. The 'critical frequency' is-

a) the lowest frequency returned from the horizon.

b) the optimum traffic frequency for a given propagation path.

c) the most stable frequency for day and night use.

d) the highest frequency which will be reflected when a wave strikes a layer at vertical incidence.

32. What happens to waves entering a layer when their frequency is above the critical frequency for that layer?

a) They get trapped between the ionised layers and attenuated.

b) They are attracted to the sun and reradiated as heat.

c) They pass through that layer to the next layer, where they are either reflected or pass through into space.

d) They are reflected back to earth.

---

33. High absorption of MF and HF waves takes place during the day in the-

a) D layer. b) E layer. c) F1 layer. d) F2 layer.

---

34. For daytime communication in the HF band over distances of up to 1000 miles (1600km), reflection is most likely to be from the-

a) D layer. b) E layer. c) F1 layer. d) F2 layer.

---

35. Sometimes greatly increased propagation distances are obtained, particularly in the VHF band, this is due to a phenomenon called-

a) Sporadic E. b) Dynamic D.

c) Teselated tropo. d) Filtered F.

---

36. When the condition referred to in Q35 occurs, it is due to-

a) natural oscillations in the F2 layer.

b) irregular, and highly ionised cloud-like areas in the E layer causing reflection of the radio wave.

c) rain clouds beyond the blue horizon.

d) secondary bouncing of the signal from sea water.

37. When the condition refered to in Q35 occurs, transmission path distances in the VHF band may be extended by typically up to-

a) 38km. b) 75km. c) 1000km. d) 6000km.

---

38. The 'maximum usable frequency' (MUF)-

a) refers to the band edge at 30MHz.

b) specifies the highest output frequency of a transmitter.

c) is the highest frequency that will be reflected when a wave strikes a layer at vertical incidence.

d) is the highest frequency for a given communication path.

---

39. MUF's are highest-

a) at or near midnight or early morning.

b) at or near noon or early afternoon, and also during periods of high sunspot activity.

c) during early evening, when tropo-ducting might occur.

d) as a general rule of thumb, when there is an R in the month.

---

40. The 'optimum traffic frequency', or optimum frequency for communication is-

a) chosen to be 10MHz above the MUF.

b) chosen to be 2MHz below the MUF.

c) chosen to be lower than the MUF by a safety margin of about 15% to allow for changes in the ionosphere.

d) normally 15% lower than the 'critical frequency'.

41. A radio wave will travel through the ionosphere and out into space without being refracted or reflected back to earth if-

a) it's frequency is above 470kHz.

b) there is a harsh frost followed by a full moon.

c) it's frequency is below the critical frequency.

d) it's frequency is much greater than the MUF.

---

42. A typical F2 layer, single hop skip distance is about-

a) 10 - 50km. b) 50 - 100km.

c) 24,000km. d) 800 - 4000km.

---

43. The distance covered by the ground wave-

a) increases with frequency.

b) decreases with frequency.

c) is independent of frequency.

d) is dependent on the height of the F2 layer.

---

44. MUF's are highest-

a) during periods of maximum sunspot activity.

b) during periods of minimum sunspot activity.

c) when there is maximum cloud cover.

d) when the weather is humid.

---

45. At and around noon, MUF's are-

a) normally higher than at dawn.

b) normally lower than at dawn.

c) the same as at dawn.

d) the same as at midnight.

46. Which is the most important layer for long distance working (Dx'ing) in the HF band?

a) D   b) E   c) F1   d) F2

---

47. The troposphere extends to approximately-

a) 1000km above the earths surface.

b) 2000km above the earths surface.

c) 10km above the earths surface.

d) 1.25km above the earths surface.

---

48. The ground wave is essentially-

a) horizontally polarised.

b) vertically polarised.

c) circularly polarised.

d) cross polarised.

---

49. A radio wave transmitted in the HF band could have its range extended to 8000km or more by means of-

a) a large metal reflector behind the antenna.

b) low loss, twin balanced feeder for the antenna.

c) increasing the speed of propagation to 3×10^2 m/s.

d) multiple hop propagation.

---

50. Fading at the receiver may be caused by-

a) signals arriving at the receiver via different paths and cancelling each other.

b) obstructions in the skip distance.

c) variations in temperature of the earths core.

d) the operators keying technique.

51. Selective fading is caused by-

a) black holes in the F2 layer.

b) hypersensitive gyro-resonance in the E layer.

c) the use of an incorrect receive I.F. filter.

d) the different frequency components of the sidebands of the received signal fading independently.

---

52. Selective fading referred to in Q 51 may be reduced by-

a) waiting for the black holes to ionise.

b) increasing the frequency to 4 times the critical frequency.

c) changing the filter.

d) the use of single-sideband (SSB) transmission and reception

---

53. The skip zone is the-

a) distance between the two antennas.

b) distance from the point of reflection to the receiver.

c) dead zone, from the end of the ground-wave, to the start of the area illuminated by the reflected sky-wave.

d) diameter of the area illuminated by the sky-wave.

---

54. The principle mode of propagation in the VHF/UHF band is-

a) moon bounce.

b) extended line of sight, between elevated antennas.

c) sky-wave reflection from the ionosphere.

d) ground-wave, best over sea paths.

55. To achieve the greatest distances on the VHF/UHF bands during normal propagation conditions-

a) there has to be a sunspot minima.

b) there has to be a sunspot maxima.

c) powers of less than 150 watts should be used otherwise insulation breakdown will occur in the ionosphere.

d) the antennas and locations should be as high as possible and the propagation path clear of obstructions.

---

56. The normal range of a VHF transmission is-

a) about 250km in winter and 400km in summer.

b) line of sight, extended by a factor equivalent to increasing the earths radius by $4/3^{rds}$.

c) approximately double the E layer distance.

d) fairly constant at 6.284km.

---

57. It is sometimes possible to achieve short term, long distance communication in the VHF band when certain natural phenomena occur, one of which is sporadic E, another is-

a) auroral storms.

b) hertzian dipole effect.

c) north-south rainbows.

d) earthquake activity.

---

58. Another well-known form of short term, long distance propagation occurs at VHF due to-

a) bucketing in the troposphere.

b) ducting in the troposphere.

c) the ionospheric vacuum effect.

d) steam train effect.

59. The range of VHF signals may also be increased by a mode of propagation called-

a) tropospheric scatter.
b) sun bounce.
c) terrestrial F.
d) sonic scatter.

---

60. You have set up a line of sight VHF path over flat, good conductivity ground, but the received signal is very much weaker than expected, a possible cause is-

a) absorption in the D layer.
b) gyro resonance in the E layer.
c) the transmitted signal being so great that it is reflected back off of the troposphere.
d) the direct wave and the ground reflected wave arriving at the receive antenna out of phase.

---

61. How could you overcome the problem encountered in Q 60?

a) wait until the D layer deionises.
b) wait until the E layer returns to normal.
c) reduce power.
d) gradually increase or decrease the height of one of the antennas until the signals increase.

---

62. It is possible for VHF signals to be received at the opposite side of a mountain or ridge when-

a) the signals are below 146MHz.
b) knife edge diffraction occurs.
c) the signal wavelength does not exceed 2 metres.
d) the top is covered with sandy soil.

14. PROPAGATION

1	b	21	d	41	d
2	a	22	c	42	d
3	d	23	b	43	b
4	a	24	b	44	a
5	b	25	c	45	a
6	a	26	c	46	d
7	d	27a	300-3000kHz	47	c
8	b	b	3-30MHz	48	b
9	a	c	30-300MHz	49	d
10	c	d	300-3000MHz	50	a
11	b	28	d	51	d
12	b	29	a	52	d
13	a	30	c	53	c
14	c	31	d	54	b
15	c	32	c	55	d
16	b	33	a	56	b
17	a	34	b	57	a
18	a	35	a	58	b
19	b	36	b	59	a
20	b	37	c	60	d
		38	d	61	d
		39	b	62	b
		40	c		

15. ANTENNAS

1. A single wire can be used as a transmission line to connect a transmitter to an antenna, but two disadvantages are that-

   a) it will radiate and needs a good earth return.

   b) it will not withstand high currents or high voltages.

   c) its skin resistance is high and power dissipation is low.

   d) it is expensive and must be operated in a vacuum.

---

2. A transmission line, or feeder, consisting of two parallel wires moulded into a polythene ribbon is shown in fig.1. Does this type of feeder radiate energy?

   a) No.

   b) Yes, mainly during periods of high sunspot activity.

   c) Yes, but only a small ammount when properly terminated.

   d) Yes, it should only be operated in a copper screen.

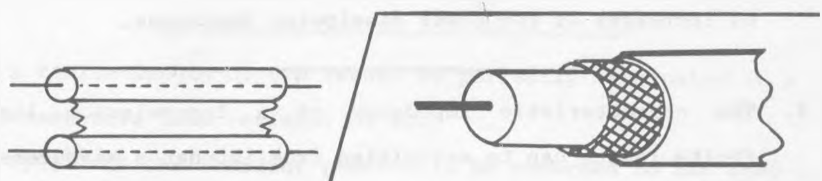


Fig.1 Fig.2

3. The type of feeder cable shown in fig.2 is-

   a) coaxial. b) triaxial. c) balanced. d) MICC.

---

4. A good quality cable of the type shown in fig.2 will have no external radiation, but if it has, it could be due to-

   a) a poor quality screen or outer conductor (the braid).

   b) the conductive material used for the dielectric.

   c) the plastic outer not being thick enough.

   d) the inner conductor being highly conductive.

5. The characteristic impedance (Z_O) of a transmission line is-

a) the d.c. loop resistance.

b) the impedance of a 1 metre length of open-circuit line.

c) the impedance of a 1 metre length of short-circuit line.

d) the input impedance of a uniform line of infinite length.

---

6. The (Z_O) of a transmission line as shown in fig.1 is mainly dependent upon-

a) the temperature of the line.

b) the spacing between, and the diameter of the wires.

c) the terminating resistance of the line.

d) the current carrying capacity of the feeder.

---

7. The attenuation of transmission line-

a) decreases with frequency.

b) increases with frequency.

c) is independent of frequency.

d) increases as the power dissipated decreases.

---

8. The characteristic impedance of a transmission line of finite length can be calculated from impedance measurements of the line, short-circuited and open-circuited, and applying the formula-

a) $Z_O = \sqrt{Z_{o/c} Z_{s/c}}$ b) $Z_O = Z_{o/c} Z_{s/c}$

c) $Z_O = Z_{o/c} / Z_{s/c}$ d) $Z_O = Z_{s/c} / Z_{o/c}$

9. The velocity of a wave travelling in a length of feeder is-

a) slower than its velocity in free space.

b) faster than its velocity in free space.

c) is the same as its velocity in free space.

d) equal to the speed of light.

---

10. What is the typical velocity factor of a polythene dielectric coaxial feeder?

a) 0·5 b) 0·65 c) 0·85 d) 0·96

---

11. What is the typical velocity factor of a polythene insulated balanced twin feeder?

a) 0·5 b) 0·65 c) 0·85 d) 0·96

---

12. A typical air-spaced twin feeder might have a velocity factor of about-

a) 0·65 b) 0·85 c) 0·96 d) 1·25

---

13. If a finite length of 50Ω feeder is perfectly terminated in a non-inductive load resistor of 50Ω-

a) 1/50th of the incident power will be returned to the feeder.

b) no power is dissipated in the load.

c) all the power will be absorbed by the generator.

d) no power will be returned from the load to the feeder.

14.

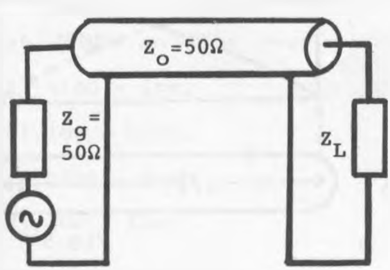


Fig.3

Referring to fig.3. Maximum power will be transferred from the generator to the load when-

a) Z_L = 300Ω b) Z_L = 100Ω

c) Z_L = 50Ω d) z_L = 25Ω

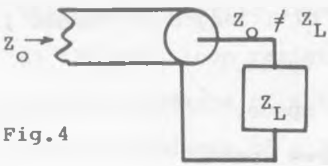
15. 

Fig.4

Fig.4 shows a line terminated in an impedance other than its characteristic impedance, this will result in-

a) a mismatch, with power being reflected back into the cable.

b) a mismatch, and no power will reach the load.

c) all the incident power being absorbed by the load.

d) all the reflected power being absorbed by the load.

---

16. When the end of a feeder is short-circuit-

a) all the incident power is dissipated by the short-circuit.

b) all the incident power is reflected by the short-circuit.

c) all the generator power is dissipated by the short-circuit.

d) no power will leave the generator.

---

17. An antenna is connected to a transmitter by a feeder cable whose impedance does not match the antenna, therefore-

a) the polarization of the antenna will reverse.

b) it will never be possible to radiate more than 1·414 Watts.

c) the antenna will overheat and melt.

d) standing waves will appear on the feeder.

---

18. A quarter-wave length of coaxial cable can be used as a wavetrap by connecting it across an antenna feeder. What is the impedance of the quarter-wave, open circuit stub shown in fig.5, looking in from point A?

a) Very low. b) Very high.

c) 50Ω d) 300Ω

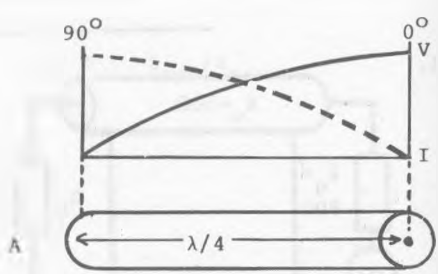


Fig.5

19. A quarter-wave open circuit stub is made from a length of coaxial cable having a velocity factor of 0·65, it is to be fitted across the feeder of a TV antenna to attenuate a 70MHz (4 metre) signal from an amateur transmitter. What is the approximate length of the stub?

a) 0·35m. b) 0·7m. c) 2·33m. d) 4·28m.

---

20. Referring to Q19. What problem could use of this stub cause?

a) Parasitic oscillation in the TV IF stages.

b) Attenuation of TV signals around UK UHF channels 23, 40 and 58, i.e. 490, 630 and 770MHz which are odd multiples of the fundamental frequency of the stub.

c) Overloading of the TV receiver by signals at 910MHz.

d) Electrolytic corrosion of the TV antenna.

---

21. A quarter-wave short circuit stub is made from a length of coaxial cable having a velocity factor of 0·65, it is to be fitted across the feeder of a 70MHz (4 metre) amateur transmitter to reduce the level of the 2^{nd} harmonic and other even harmonics. What is the approximate length of the stub?

a) 0·35m. b) 0·7m. c) 2·33m. d) 6·5m.

---

22. Referring to Q21 above. The input impedance of the stub at 70MHz and the even harmonic frequencies respectively is-

a) high - low.

b) low - high.

c) high - high.

d) low - low.

23. In order to obtain maximum power transfer from the feeder to the antenna, and to avoid standing waves being set-up on the feeder, it is sometimes necessary to employ matching devices of one type or another. Two types of matching device are the-

a) magnetic base mount and capacitance top.

b) SWR meter and the quarter-wave 'rat trap'.

c) dip oscillator and the ferrite ring.

d) quarter-wave line section and the stub tuner.

24.

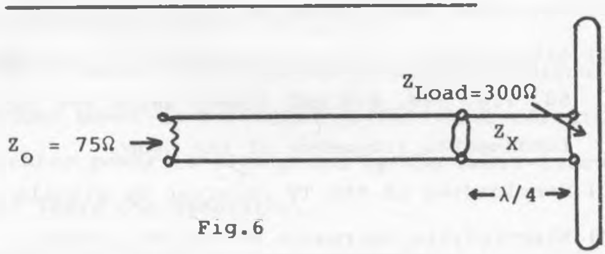


Fig.6

To match the 75Ω twin feeder to the 300Ω folded dipole it has been decided to use a quarter-wave section of transmission line as shown in fig.6. What characteristic impedance is necessary for the quarter-wave line if it is to provide a good match between the feeder and the antenna?

Note. $Z_X = \sqrt{Z_o \, Z_{Load}}$

a) 75Ω b) 150Ω c) 300Ω d) 450Ω

---

25. What is the loss in dBs of the length of coaxial cable shown in fig.7, when the power sent at 'A' is 100 Watts and the power received at 'B' is 50 Watts?

Fig.7

a) 0·5dB.

b) 3dB.

c) 6dB.

d) 20dB.

26. Connecting a balanced dipole to an unbalanced feeder might result in radio frequency currents flowing on the outside of the feeder screen. What could be used at the termination to prevent this problem?

a) A balun.
b) A SWR meter.
c) A leaky feeder.
d) An audio filter.

---

27. When the VSWR on an antenna and feeder system is very large-

a) there could be a complete mismatch or faulty feeder.
b) the antenna and feeder are correctly matched.
c) the antenna has been replaced by a dummy load equal to the Z_o of the feeder cable.
d) the transmitter output stage is faulty.

---

28. When the VSWR on an antenna feeder is unity-

a) there is a complete mismatch between antenna and feeder.
b) there is a perfect match between antenna and feeder.
c) it is likely that the antenna has been disconnected.
d) the antenna has been replaced by a short-circuit.

---

29. What can be done at the sending end to remove standing waves?

a) Change to the FM mode of transmission.
b) Retune the Pi-tank circuit of the transmitter.
c) Fit a narrow band BPF at the transmitter output.
d) Nothing, because standing waves are generated at the distant end.

30. Which two devices listed below are suitable for VSWR measurements?

a) 'Q' meter and LCR bridge.

b) Moving coil meter and calibrated plumb-line.

c) Moving iron meter and hydrometer.

d) Reflectometer and slotted line.

---

31. Using one of the devices from the pair that you selected in Q 30 above, you are able to measure the maximum and minimum value of the standing wave by means of a sliding probe. What is this device called?

a) A reflectometer.

b) A slotted line.

c) A calibrated plumb-line.

d) An LCR bridge.

---

32. Using the device selected in Q 31 above, and with it inserted in the line, you detect a maximum reading of 2 volts and a minimum reading of 1 volt. What is the VSWR?

a) 2:1 b) 5:1 c) 100:1 d) 200:1

---

33. What is an isotropic radiator?

a) A radio-active device used on modern lightning conductors.

b) A device that radiates a narrow beam of light.

c) An antenna which radiates energy equally in all directions

d) An antenna which radiates only a narrow beam of energy.

34. An isotropic radiator is mainly used as a-

a) device to ionise the atmosphere.

b) device for measuring the speed of a radio wave in a cable.

c) reference with which the gain of a practical antenna is compared.

d) reference to boost the gain figure of a CB antenna by 10dB.

---

35. What is an elementary doublet?

a) A pair of phased isotropic radiators.

b) An isotropic radiator that has two distinct radiation patterns in the vertical plane.

c) A pair of full-wave dipoles arranged to give a 3dB gain.

d) A dipole of a length that is short compared with a half-wavelength, so that its current distribution can be regarded as uniform.

---

36. The electric 'E' field associated with a vertical dipole is said to be-

a) horizontally polarized. b) vertically polarized.

c) circularly polarized. d) radially polarized.

37. What type of polarization gives the strongest ground waves?

a) Horizontal. b) Vertical.

c) Circular. d) Slant.

---

38. A vertical antenna is said to radiate a-

a) horizontally polarized wave.

b) vertically polarized wave.

c) radially polarized wave.

d) circularly polarized wave.

39. In order to obtain the maximum signal at the receiver-

a) the receive antenna must have the same polarization as the transmit antenna.

b) the receive antenna must be of opposite polarization to the transmit antenna.

c) a quarter-wave dipole must be used at the receiver.

d) both antennas must be constructed of copper wire.

---

40. Radio waves in free space travel at a speed of-

a) 3×10^6 m/s b) 3×10^8 m/s c) 3×10^{10} m/s d) 3×10^5 m/s

---

41. Where λ = wavelength in metres, and f = frequency in Hertz, the wavelength of a radio wave is given by the formula-

a) $\lambda = \frac{3 \times 10^6}{f}$ b) $\lambda = \frac{300 \times 10^6}{f}$

c) $\lambda = \frac{f}{3 \times 10^8}$ d) $\lambda = f \times 3 \times 10^8$

---

42. What is the wavelength of a 10MHz signal?

a) 10m b) 15m c) 25m d) 30m

---

43. The actual, or physical length of a resonant half-wave dipole is about 5% less than its calculated electrical length, this is due to-

a) the high dielectric constant of free space.

b) the insulation resistance of the antenna feedpoint.

c) the oxygen content of the atmosphere.

d) the velocity of propagation on the wire being slower than it is in free space.

44. The feedpoint resistance of a centre-fed half-wave dipole is about-

a) 37Ω b) 72Ω c) 300Ω d) 600Ω

---

45. The feedpoint resistance of a quarter-wave ground-plane antenna is about-

a) 37Ω b) 72Ω c) 150Ω d) 300Ω

---

46. What is the electrical length of a half-wave dipole operating at a frequency of 21MHz?

a) 110m b) 30m c) 7•14m d) 2•08m

---

47. The practical or physical length of the half-wave dipole operating at 21MHz as in Q 46 is about-

a) 100m b) 28•5m c) 6•8m d) 1.99m

---

48. The centre-fed dipole is-

a) an unbalanced antenna.

b) a balanced antenna.

c) a concentric antenna.

d) an isotropic antenna.

---

49. The ends of a resonant half-wave centre-fed dipole are-

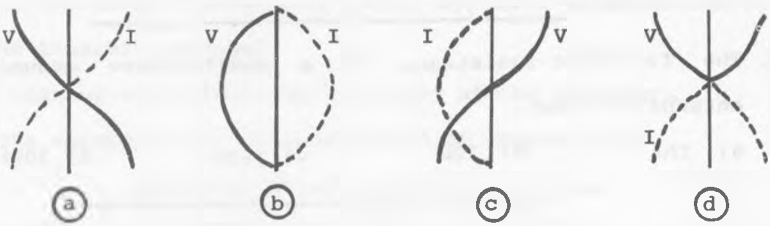
a) high current points and require grounding.

b) low resistance points and need to be well insulated.

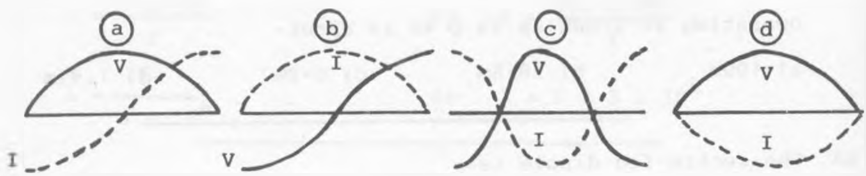
c) low voltage points and require a good earth connection.

d) high voltage points and require good insulators.

50. Which one of the diagrams shown below represents the voltage and current distribution on a resonant centre-fed half-wave dipole?



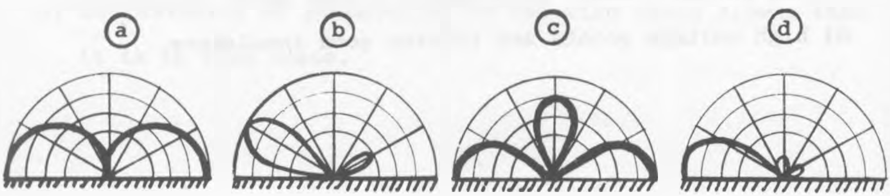
51. Which one of the diagrams shown below represents the voltage and current distribution on a resonant half-wave end-fed antenna?



52. Referring to Q 51 above. It may be deduced that the resonant half-wave end-fed antenna has a feedpoint impedance that is-

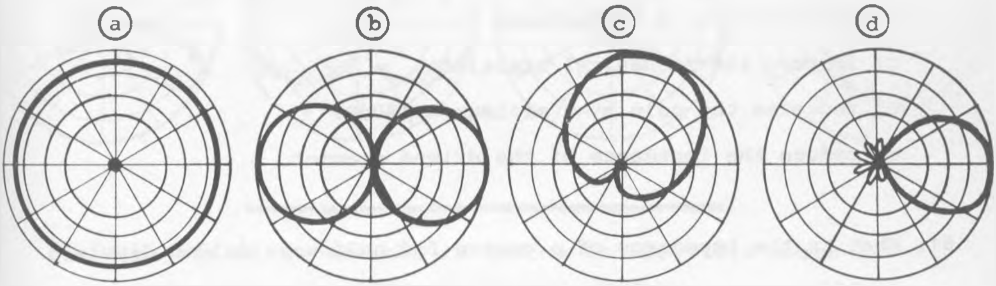
a) low. b) high. c) zero. d) 50Ω

53. Which one of the vertical plane patterns shown below is characteristic of a vertical quarter-wave ground-plane antenna?



54. Which one of the polar diagrams shown below in Q55 is typical of the radiation pattern in the horizontal plane, of a vertical 5/8 wave ground plane antenna?

55. Which one of the polar diagrams shown below represents the radiation pattern in the horizontal plane of a vertical quarter-wave ground-plane antenna?



56. An ideal ground plane for a vertical antenna system would be-

a) an infinitely large copper sheet.

b) several acres of dry rock.

c) a large damp plastic sheet.

d) radial wires, half-wavelength long and buried about 2 inches below the surface of the earth.

57. Referring to Q 56. Which answer would be a more practical solution to the ground plane problem?

58. An increase in the diameter of the elements of an antenna will-

a) increase the gain of the antenna.

b) increase the bandwidth of the antenna.

c) reduce the ground conductivity near to the antenna.

d) increase the earth currents near the antenna.

59. What is the name given to the type of antenna that uses additional alements in the form of directors and reflectors to give an increase in directional gain?

a) End-fed dipole. b) Collinear.

c) Yagi. d) Slim Jim.

---

60. Placing elements in front of, or behind a dipole will-

a) reduce the wind resistance.

b) improve the mechanical stability.

c) increase the gain by a minimum of 20dB.

d) reduce the impedance of the driven element.

---

61. What is the impedance of a centre fed half-wave folded dipole?

a) 50Ω b) 75Ω c) 300Ω d) 600Ω

---

62. When using a half-wave folded dipole with no directors or reflectors, a suitable feeder cable will be-

a) 50Ω Coaxial. b) 75Ω Coaxial.

c) 300Ω Twin feeder. d) 600Ω Twin feeder.

---

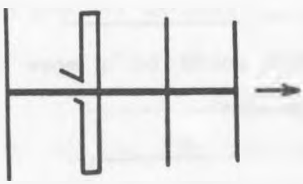
63. 

Fig.8

A Yagi antenna is shown in fig.8. The effect of using a folded λ/2 driven element will-

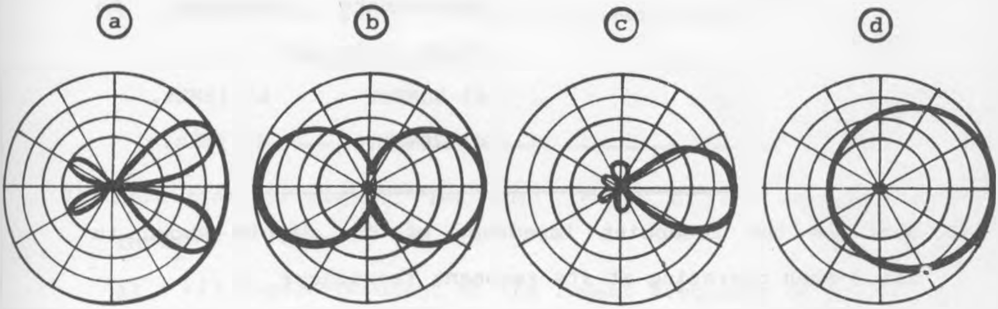
a) ensure vertical polarization.

b) restore the feedpoint impedance to about 75Ω.

c) reject horizontally polarized signals.

d) reduce the wind resistance.

64. The antenna shown in fig.8 is operated in the vertical plane. Which one of the polar diagrams shown below is typical of the radiation pattern in the horizontal plane?



---

65. The gain of an antenna is quoted in dBd, this means that-

a) the gain is referenced against a diabolic radiator.

b) the gain is referenced against a λ/2 dipole.

c) an isotropic antenna has been used as a reference.

d) the gain figures apply to dipoles only.

---

66. What is the effective gain of a λ/2 diople, using an isotropic radiator as the reference?

a) 0dB. b) 1·5dB. c) 2·15dB. d) 6dB.

---

67. The physical length of a λ /4 ground plane antenna for mobile use at 145MHz will be about-

a) 0·49m. b) 0·98m. c) 1·96m. d) 14·5m.

---

68. The physical length of a λ/2 centre fed antenna for operation at 432MHz will be about-

a) 33cm. b) 43·2cm. c) 70cm. d) 100cm.

69.

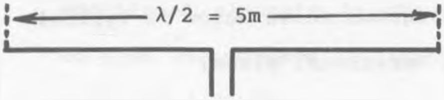


Fig.9

Fig.9 shows a centre-fed λ/2 dipole. From the given dimensions, calculate the approximate frequency to which it is cut.

a) 30MHz. b) 15MHz.

c) 20MHz. d) 7MHz.

---

70. What is the feedpoint impedance of the dipole shown in fig.9 when operating at its resonant frequency?

a) 72Ω Resistive. b) 43Ω Resistive.

c) 300Ω inductive. d) 600Ω Capacitive.

71.

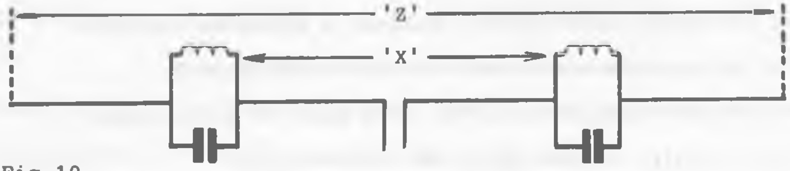


Fig.10

What type of antenna is shown in fig.10?

a) Rhombic. b) Unipole. c) Quadropole. d) Trap dipole.

---

72. The centre section 'X' of the antenna shown in fig.10 is required to operate as a λ/2 dipole at 7MHz.

What is the length 'X'?

a) 42m. b) 20·35m. c) 10·5m. d) 5·25m.

---

73. When the centre section 'X' of the antenna shown in fig.10 is dimensioned to operate at 7MHz, the two tuned circuits should be resonant at-

a) 28MHz. b) 21MHz. c) 14MHz. d) 7MHz.

74. Referring to fig.10. The centre length 'X' forms-

a) a $\lambda/2$ dipole resonant at the highest frequency of operation.

b) the matching device for the traps.

c) the matching section for the antenna system.

d) the anti-interference trap.

---

75. Referring to fig.10. The full length of the antenna 'Z', forms

a) a $\lambda/2$ dipole resonant at the lowest frequency of operation.

b) a $\lambda/2$ dipole resonant at the highest frequency of operation.

c) the matching device for the traps.

d) the anti-interference trap.

---

76. Referring to fig.10. The full length of the $\lambda/2$ dipole is about 33•5m. Which one of the frequency bands shown below would you expect it to be resonant in?

a) 1•8MHz. b) 3•5MHz. c) 7MHz. d) 14MHz.

---

77. The lowest frequency of operation for the dipole shown in fig.10 is in the 80 metre band. Why is its overall length 'Z' shorter than might have been calculated?

a) Because of the added inductance of the traps.

b) Because of the added capacitance of the traps.

c) Because of the propagation time of the feeder at the lower frequencies.

d) Because of the coupling effect of the atmosphere.

78. In addition to operation at 7MHz and 3•5MHz, the trap dipole shown in fig.10 will operate on-

a) harmonic frequencies, 14, 21 and 28MHz.

b) sub harmonic frequencies, 1•8MHz, 900kHz and 450kHz.

c) 10 and 20MHz cnly.

d) all of the VHF and UHF bands.

79.

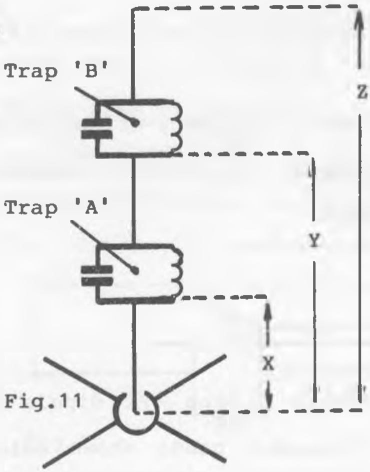


Fig.11

Fig.11 shows a three band trapped vertical antenna for operation at 10, 15 and 20 metres. In which frequency band does the shortest length 'X' operate as a ground-plane λ/4 antenna?

a) 7MHz. b) 14MHz.

c) 21MHz. d) 28MHz.

---

80. What is the approximate resonant frequency of trap 'B' fig.11 ?

a) 7MHz. b) 14MHz. c) 21MHz. d) 28MHz.

---

81. The full length 'Z' of the antenna shown in fig.11 will operate as a resonant λ/4 ground-plane antenna at a frequency of about-

a) 7MHz. b) 14MHz. c) 21MHz. d) 28MHz.

---

82. What is the resonant frequency of trap 'A' fig.11?

a) 7MHz. b) 14MHz. c) 21MHz. d) 28MHz.

83. Why is the height above ground of a HF antenna an important factor? Because-

a) wind loading becomes a problem.

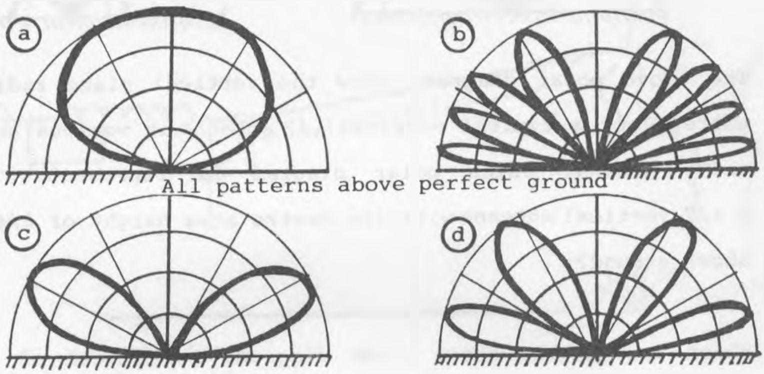
b) the weight of the antenna increases in direct proportion to the height.

c) TVI will increase from the traps as the air gets thinner.

d) the radiation pattern varies with height.

84.

These diagrams are in a plane at right angles to the wire.



The above polar diagrams show the vertical plane radiation patterns of a horizontal λ/2 antenna at various heights above ground. Which polar diagram is representative of the antenna erected at a height of λ/4 above ground?

---

85. Which one of the above polar diagrams is typical of a λ/2 horizontal antenna at a height of λ/2 above ground.

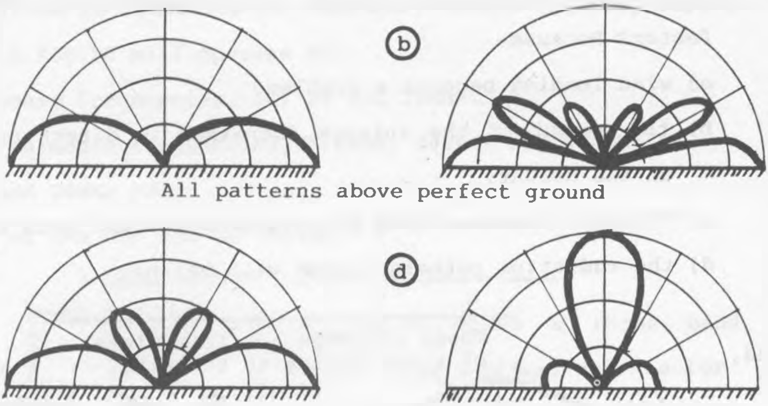
---

86. Which one of the above polar diagrams is typical of a λ/2 horizontal antenna at a height of 1λ above ground?

---

87. Which one of the above polar diagrams is typical of a λ/2 horizontal antenna at a height of 2λ above ground?

88.



All patterns above perfect ground

The above polar diagrams show the vertical plane radiation patterns of a typical vertical $\lambda/2$ antenna at various heights above ground. Which polar diagram is representative of a $\lambda/2$ vertical antenna with its centre at a height of $\lambda/4$ above ground?

89. Which one of the above polar diagrams is typical of a $\lambda/2$ vertical antenna with its centre at a height of $\lambda/2$ above ground?

90. Which one of the above polar diagrams is typical of a $\lambda/2$ vertical antenna with its centre at a height of 1λ above ground?

91. For long distance (Dx) communication in the HF band, the antenna must be capable of-

a) high angle radiation.

b) low angle radiation.

c) ground attenuated radiation.

d) causing gyro-resonance in the D layer.

92. For short distance sky wave communication (100-500 miles), the antenna must be capable of-

a) high angle radiation.

b) low angle radiation.

c) ground attenuated radiation.

d) causing gyro-resonance in the E layer.

93.

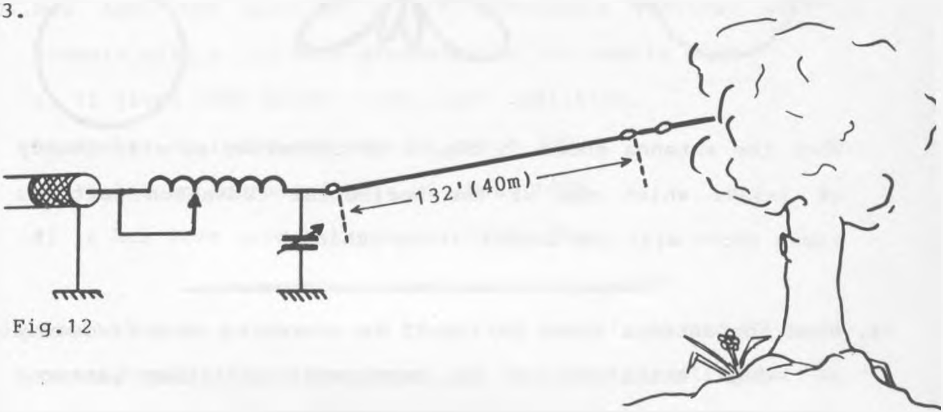


Fig.12

Fig.12 shows an end-fed antenna suitable for harmonic operation with its associated tuner unit to bring the system to resonance. At which frequency will the antenna operate as a $\lambda/4$ antenna?

a) 1·8MHz. b) 3·5MHz. c) 21MHz. d) 28MHz.

---

94. The antenna shown in fig.12 can be operated as a $\lambda/2$ end-fed antenna at a frequency of-

a) 1·8MHz. b) 3·5MHz. c) 21MHz. d) 28MHz.

---

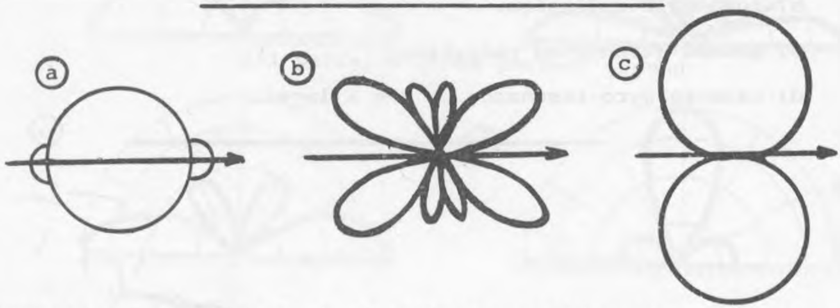
95. How many wavelengths is the antenna shown in fig.12 at a frequency of 14MHz?

a) 1 b) 2 c) 3 d) 4

96. How many wavelengths is the antenna shown in fig.12 at a frequency of 28MHz?

a) 1 b) 2 c) 4 d) 8

97.



When the antenna shown in fig.12 is operating at a frequency of 3·5MHz which one of the horizontal radiation patterns shown above will you expect it to exhibit?

---

98. When the antenna shown in fig.12 is operating at a frequency of 14MHz. Which one of the horizontal radiation patterns shown above will you expect it to exhibit?

99.

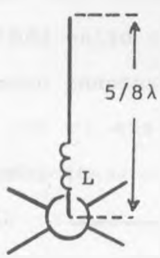


Fig.13

Fig.13 shows a 5/8λ vertical ground-plane antenna.

What advantage has it over a λ/4 ground-plane antenna?

a) 5/8λ is an optimum length that gives a gain of about 3dB over a 1/4 wave vertical antenna.

b) Economy, eight of them can be cut from a standard five wavelength length of steel wire.

c) The tip will glow when transmitting and give a good indication of the output power.

d) It gives excellent high angle radiation.

100.Referring to fig.13. What is the purpose of loading coil 'L'?

a) It absorbs mechanical shock when the whip is struck by overhead obstructions.

b) It is tuned to reject lightning strikes.

c) It tunes the 5/8 wave whip to 3/4 wave resonance.

d) It assists the high angle radiation pattern.

101.How does the gain of a 5/8 wavelength vertical antenna compare with a 1/4 wave ground-plane for mobile use?

a) It gives 10dB better high angle radiation.

b) It has an increased gain of about 3dB.

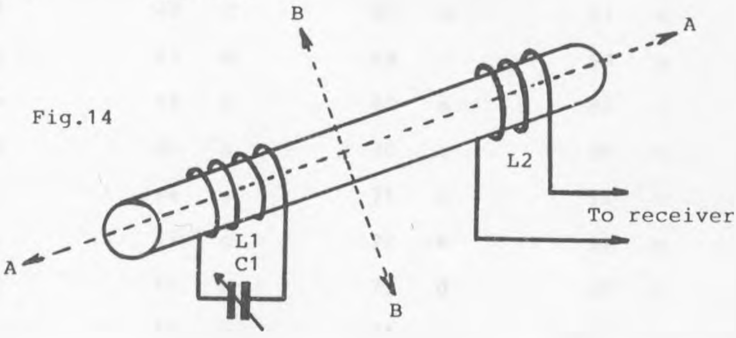
c) It has an increased gain of about 10dB.

d) It has less gain but greater bandwidth.

102.Fig.14 shows a ferrite rod receiving aerial, L1 and C1 are tuned to the signal frequency. L2 is a link coupling to the receiver. Which is the direction of maximum response?

a) A - A b) B - B

Fig.14



103.Referring to fig.14. Which is the direction of minimum response?

a) A - A b) B - B

15. ANTENNAS

1	a	26	a	51	b	76	b
2	c	27	a	52	b	77	a
3	a	28	b	53	a	78	a
4	a	29	d	54	a	79	d
5	d	30	d	55	a	80	c
6	b	31	b	56	a	81	b
7	b	32	a	57	d	82	d
8	a	33	c	58	b	83	d
9	a	34	c	59	c	84	a
10	b	35	d	60	d	85	c
11	c	36	b	61	c	86	d
12	c	37	b	62	c	87	b
13	d	38	b	63	b	88	a
14	c	39	a	64	c	89	c
15	a	40	b	65	b	90	b
16	b	41	b	66	c	91	b
17	d	42	d	67	a	92	a
18	a	43	d	68	a	93	a
19	b	44	b	69	a	94	b
20	b	45	a	70	a	95	b
21	b	46	c	71	d	96	c
22	a	47	c	72	b	97	c
23	d	48	b	73	d	98	b
24	b	49	d	74	a	99	a
25	b	50	c	75	a	100	c
						101	b
						102	b
						103	a

16. TRANSMITTER INTERFERENCE

1. You have set the carrier frequency of an AM telephony transmitter 1kHz inside its allocated band, it is then modulated with a speech signal which contains frequency components in the range 300-3000Hz. What is wrong?

   a) Nothing.

   b) You should be using FM this close to the band edge.

   c) One of your modulation sidebands will extend 2kHz into the adjacent frequency band.

   d) Your complete signal is inverted and appears in a band which you are not licensed to use.

---

2. You are operating an AM telephony transmitter 3·2kHz inside your permitted band edge, what might now cause you to infringe the regulations?

   a) Nothing.

   b) The transmitter might drift outside its allocated band.

   c) The distant receiver might be switched to the CW mode.

   d) You might not be radiating enough harmonics.

---

3. You are operating a frequency modulated transmitter near the centre of the 2 metre amateur band, but due to the deviation limiter being incorrectly adjusted, your deviation is wider than it should be, this is likely to result in-

   a) harmonics of the carrier frequency causing TVI.

   b) detuning of the frequency multiplier stages.

   c) image channel interference at the receiver.

   d) interference to adjacent channels.

4. Your transmitter has an unacceptable amount of frequency drift. What is the cause?

   a) The multiplier stages if used, are drifting.

   b) The cut-off frequency of the transmit low pass filter is drifting with temperature.

   c) The carrier frequency oscillator is drifting.

   d) The power supply is allowing the 25^{th} harmonic of the mains frequency through to lock the oscillator.

---

5. The most likely cure for the problem encountered in Q 4 above is-

   a) better ventilation of the multiplier stages.

   b) increasing the pass band of the low pass filter.

   c) voltage and temperature stabilization of the carrier frequency oscillator.

   d) improved power supply filtering.

---

6. Excessive transmission bandwidth is undesirable because it-

   a) always interferes with TV receivers.

   b) might damage receiver IF filters.

   c) reduces the effectiveness of the low pass filter.

   d) will cause adjacent channel interference and be wasteful of frequency spectrum.

---

7. What precautions should be taken in the transmitter modulator stage to ensure that the transmitted bandwidth is only that necessary for the transmission of intelligible speech?

   a) Include an audio low pass filter.

   b) Place a block of polystyrene over the audio transistors.

   c) Stabilize the modulator power supply.

   d) Include an audio high pass filter.

8. The typical upper cut-off frequency for the audio low pass filter in the modulation amplifier stage of an amateur transmitter is about-

a) 450 - 500Hz b) 455 - 470kHz.

c) 10 - 100Hz d) 2500 - 3000Hz

---

9. The RF bandwidth of a typical double sideband (DSB) amateur transmission is of the order of-

a) 3kHz b) 6kHz c) 10kHz d) 75kHz

---

10. The RF bandwidth of a typical single sideband (SSB) amateur transmission is of the order of-

a) 3kHz b) 6kHz c) 10kHz d) 75kHz

---

11. The RF bandwidth of a typical CW on-off keyed telegraphy transmission will be-

a) 3kHz.

b) equal to the oscillator drift.

c) zero, no bandwidth is used.

d) fairly narrow, but proportional to the keying speed and the characteristics of the 'key click filter'.

---

12. It is bad practice to key the transmitter VFO because it might affect the oscillator stability and also cause-

a) a 'chirp' at the distant receiver.

b) a very large 3^{rd} harmonic.

c) a very large 5^{th} harmonic.

d) a heavy drain on the power supply.

13. A CW transmitter has a keying current waveform as shown in fig.1. What is the associated problem?

Fig.1

a) There is no problem.

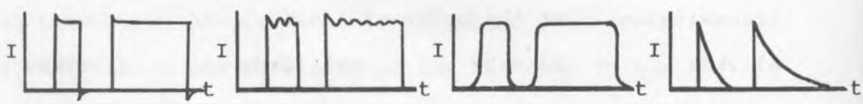
b) There will be no harmonic content in the output signal.

c) The power supply filter might suffer flashover.

d) Excessive sidebands will be generated, causing clicks in receivers tuned to adjacent channels.

---

14. a) b) c) d)

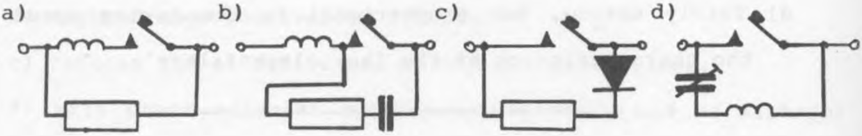


Which one of the above keying current waveforms will give the cleanest RF output from a CW transmitter?

---

15. Which one of the circuits shown below is suitable for use as a 'key click filter' in the key of a CW transmitter?

a) b) c) d)



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16. Sparking at the key contacts, and radiation from the lead connecting the key to the transmitter is likely to cause-

a) 'whistler waves' which radiate worldwide.

b) local interference, clicks and thumps on radio, flashes on television screens.

c) overheating of the PA stage.

d) flashover at the mains supply cable.

17. It might be possible to reduce or eliminate the problem referred to in Q 16 by-

a) fitting a band pass filter in the antenna.

b) keying a very low current point in the transmitter, using screened leads from the key to the transmitter, and including a 'key click filter'.

c) the use of large heat sinks on the PA transistors.

d) the use of silicon rubber insulated cable for the key.

---

18. What are spurious emissions?

a) The modulated sidebands.

b) The various temperature differentials emitted from the case of the transmitter.

c) Any frequency at the output of a transmitter other than the intended frequency.

d) Any band of frequencies not present at the output of a transmitter.

---

19. From what point on a transmitter are spurious emissions likely to be radiated?

a) The antenna only.

b) Directly from the low pass filter.

c) From any part of the transmitter, cabinet, wires, filters, components and antenna.

d) From the main radio station earth only.

20. What are harmonics?

a) Musical notes emitted from the low pass filter during CW transmissions.

b) Overtones of the crystal oscillator which appear as tones at the distant receiver.

c) Signals at multiples of the final output frequency, or multiples of frequencies used to generate the final frequency.

d) Two co-channel signals on an antenna.

---

21. What are parasitic oscillations?

a) Unwanted oscillations that occur at any frequency, anywhere in a transmitting or receiving system.

b) The wanted oscillations and harmonics from a self starting crystal oscillator.

c) Wanted oscillations produced by a heterodyning process.

d) Oscillations that can occur on a resonant antenna due to small plastic-devouring termites in the feeder.

22.

Fig.2

The amplitude modulated wave shown in fig.2 is said to be-

a) under-modulated.

b) over-modulated.

c) under-powered.

d) over-powered.

23. When the output signal of an AM transmitter is as shown in fig.2-

a) all is well.

b) it is switched to the CW mode.

c) the power supply has failed.

d) it is likely to be causing splatter in adjacent channels.

---

24. Listed below are four classes of emission, which one is the least likely to cause interference to TV and radio reception?

a) A1A. CW on-off telegraphy.

b) A3E. Double sideband amplitude modulation.

c) J3E. Single sideband suppressed carrier.

d) F3E. Frequency modulation.

---

25. Harmonics are present at the output of all transmitters, but those with the highest harmonic output levels usually employ-

a) overdriven class C output stages.

b) linear class A output stages.

c) low pass filters with high attenuation in the pass band.

d) low pass filters with high attenuation in the stop band.

---

26. How would you reduce the level of harmonics radiated from a transmitter?

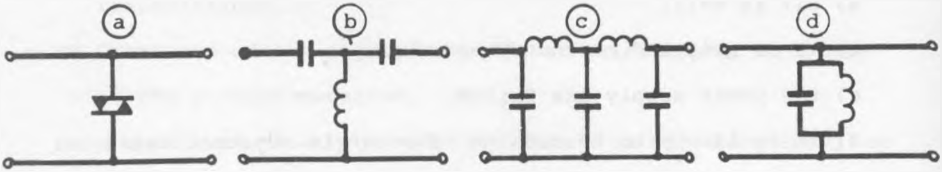
a) Fit a small neon lamp at the tip of the antenna.

b) Leave the SWR meter in the antenna feeder at all times.

c) Use a variable voltage power supply for the PA stages.

d) Use a low pass filter in the transmitter RF output.

27. Which one of the circuits shown below is a low pass filter suitable for reducing the harmonics from a transmitter?



28. Fig.3 shows a block diagram of a basic VHF transmitter. the RF output is a carrier wave and some spurious signals which are related to the various multiplier stage harmonics. What could be done to reduce the level of the spurious signals?

a) QSY to another frequency.

b) Fit a VHF bandpass filter in the transmitter output.

c) Fit a VHF bandstop filter in the transmitter output.

d) Fit a RF filter in the microphone lead.

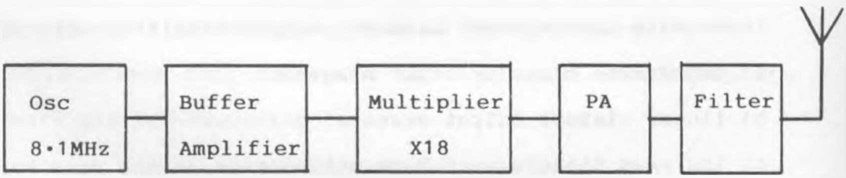


Fig.3

29. From the information given in fig.3, calculate the frequency of the third harmonic of the output frequency.

a) 24·3MHz b) 145·8MHz c) 437.4MHz d) 729MHz

30. Referring to fig.3. Where is the fifth harmonic of the output frequency likely to fall?

a) In the VHF TV band.

b) In the UHF TV band.

c) In band 2. VHF sound broadcasting.

d) In the 10GHz police radar band.

31. Parasitic oscillations in any stage of a transmitter are likely to cause-

a) spurious emissions at the transmitter output.

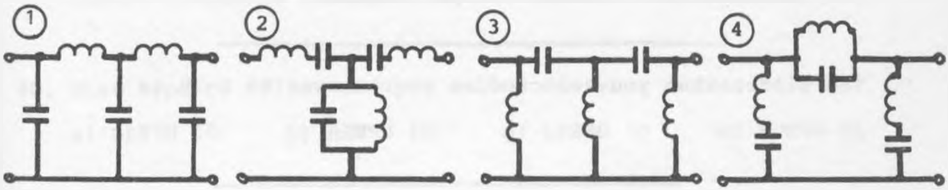
b) key clicks on distant receivers.

c) overheating of the mains filter, if fitted.

d) severe fading of the transmission in the ionosphere.

---

32. As an amateur, you are likely to encounter some, or all of the filters shown below. Place them in their correct order.



a)	b)	c)	d)
1 HPF	1 LPF	1 BSF	1 BSF
2 LPF	2 BPF	2 HPF	2 HPF
3 BSF	3 HPF	3 LPF	3 BPF
4 BPF	4 BSF	4 BPF	4 LPF

33.

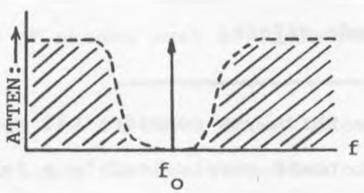


Fig.4

What type of filter has the response curve shown in fig.4?

a) BPF b) BSF

c) LPF d) HPF

34.

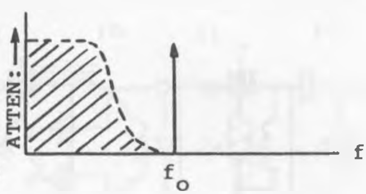


Fig.5

What type of filter has the response curve shown in fig.5?

a) BPF b) BSF

c) LPF d) HPF

35.

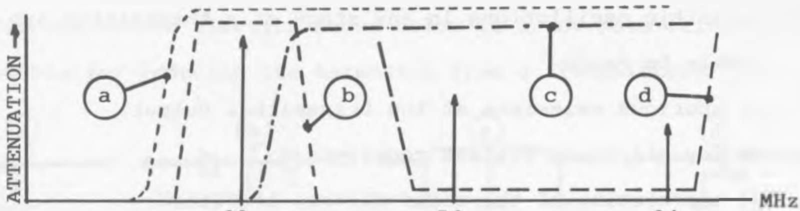


Fig.6

Fig.6 shows the spectrum of the fundamental frequency and harmonics of a 28MHz transmitter. Which filter characteristic from those shown above, would you select as suitable to reduce the levels of the unwanted output signals?

---

36. The filter that you selected as your answer to Q 35 is a-

a) BPF b) BSF c) LPF d) HPF

---

37. Ferrite beads are often used for suppression purposes at VHF, the effect of placing a ferrite bead over a wire is to-

a) increase the inductance of the wire.

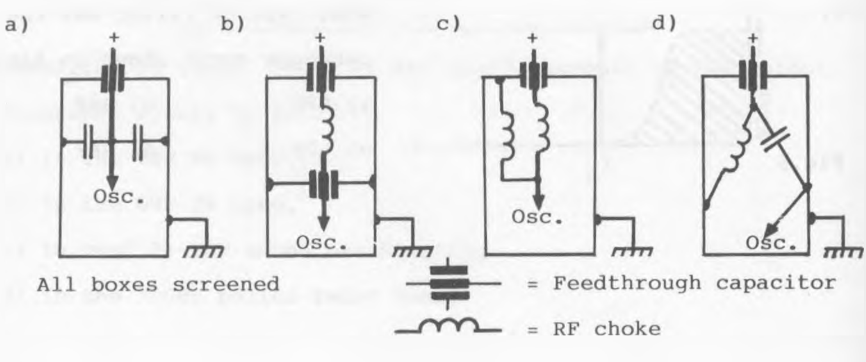
b) reduce the inductance of the wire.

c) increase the capacitance of the wire.

d) create the short circuit diode effect.

---

38. Select the circuit shown below, which you consider the most suitable for filtering the d.c. power supply lead to a fully screened oscillator or RF stage.



39.

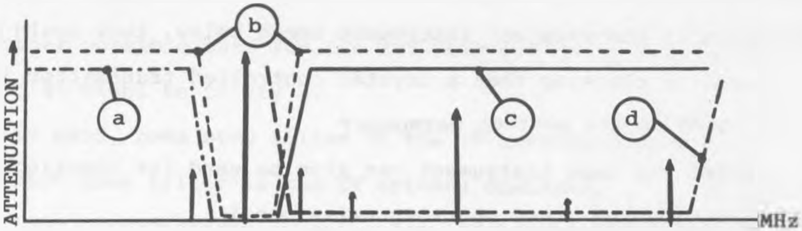


Fig.7

Fig.7 shows the spectrum of the signals present at the output of a 2 metre transmitter. The carrier frequency is at 145MHz. Which filter characteristic from those shown above would you select to reduce the level of the unwanted signals?

---

40. What type of filter did you select for your answer to Q 39?

a) BPF b) BSF c) LPF d) HPF

---

41. To obtain the maximum reduction of RF radiation from the case or cabinet of a radio transmitter-

a) a dummy load must be used.

b) a dummy load must not be used.

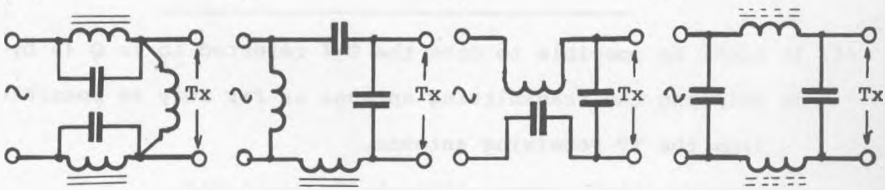
c) all earthed wires must be screened.

d) RF stages must be individually screened, decoupled and grounded.

---

42. From the circuits shown below, which would be the most suitable for the reduction of mains-borne interference from a radio transmitter?

a) b) c) d)



43. Which is the simplest instrument named below, that could be used for checking that a crystal controlled transmitter is aligned on its correct harmonic?

(Note: The same instrument can also be used for checking for harmonics and other spurious emissions.)

a) Crystal controlled frequency counter.

b) Heterodyne wavemeter.

c) RF spectrum analyser.

d) Absorption wavemeter.

---

44. A quick, accurate and easy method of checking the carrier frequency of a transmitter is to use-

a) a crystal controlled frequency counter.

b) a standing wave ratio meter.

c) an absorption wavemeter.

d) a plumb-line, calibrated by NPL to BS 8000.

---

45. It has been proved that your transmitter is free from harmonics and other spurious emissions, but it is still causing TVI, this could be due to-

a) operating the PA stage in class C.

b) powering the equipment from batteries instead of mains.

c) the temperature of the TV antenna system.

d) the signal overloading the front end of the TV receiver.

---

46. It might be possible to cure the TVI referred to in Q 45 by-

a) shifting the transmitting antenna as far away as possible from the TV receiving antenna.

b) viewing the TV screen through 3D spectacles.

c) increasing the transmitter power.

d) both b and c above.

47. Another possible cure for the TVI referred to in your answer to Q 45 might be to try a-

a) TV band, band stop filter in the TV antenna downlead.

b) high pass filter in the TV antenna downlead.

c) long ferrite earthing spike for the transmitter earth.

d) pair of back to back diodes across the TV antenna socket.

---

48. When unwanted RF currents enter the TV receiver via the screen of the antenna downlead and cause interference, it is possible to effect a cure or reduction of the interference by-

a) cutting gaps in the centre conductor of the TV feeder.

b) fitting a brass, instead of aluminium plug to the TV feeder.

c) passing the TV feeder through a 6" dia: cardboard tube.

d) winding 5 to 15 turns of the TV feeder onto a couple of ferrite rings to form a coaxial RF choke.

---

16. TRANSMITTER INTERFERENCE

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

17. MEASUREMENT

1. The basic moving coil instrument is suitable for measurement of-
   a) direct current only.
   b) alternating current only.
   c) either a.c. or d.c.
   d) resistance only.

---

2. With reference to the moving coil instrument. How is current fed to the coil?
   a) By induction from the permanent magnet.
   b) By magnetic coupling to the aluminium needle.
   c) By two hair springs, which also provide the restoring torque and temperature compensation.
   d) By energy transfer from the pole pieces of the magnet.

---

3. Why is the deflection of the basic moving coil instrument linear?
   a) Because a uniform and radial magnetic field is provided for the coil to move in.
   b) The hair springs have a uniform torque.
   c) The torque to weight ratio of the coil is low.
   d) Because a linear scale is provided.

---

4. How is needle damping provided in the moving coil instrument?
   a) By changing the direction of the magnetic field when the coil is moving.
   b) By air pressure on the pointer.
   c) By air pressure on the coil former.
   d) By eddy current action in the coil former.

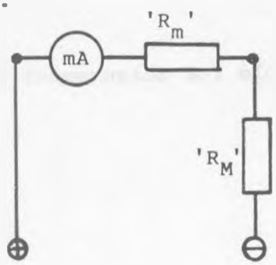
5. 

Fig.1

Fig.1 shows a basic moving coil meter, The meter resistance 'R_m' is the sum of the coil resistance and a small swamping resistor. Resistor 'R_M' is fitted to enable the meter to read d.c. voltages. It is known as a-

a) shunt. b) multiplier.

c) voltage dropper. d) voltage divider.

---

6. Fig.2 shows a basic moving coil meter with a parallel resistor 'R_s', this has been added to enable the meter to read d.c. current, it is known as a-

a) shunt.

b) multiplier.

c) voltage dropper.

d) current reducer.

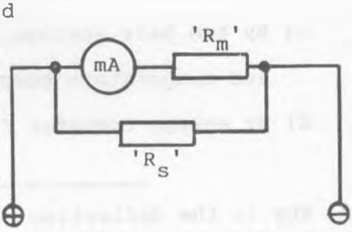


Fig.2

---

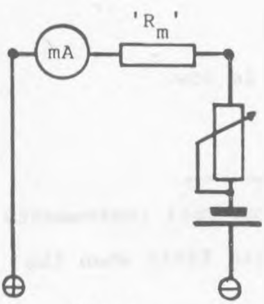
7. 

Fig.3

When a basic moving coil meter is connected as shown in fig.3, it is suitable for the measurement of-

a) current.

b) resistance.

c) voltage.

d) power. (I^2R).

---

8. The basic moving coil meter shown in fig.2 has a full scale deflection (FSD) of 1mA, and an internal resistance of 100Ω. What value of shunt resistance 'Rs' is required to extend the range of the meter to read 100mA FSD?

a) 0·1010Ω b) 1·010Ω c) 10·10Ω d) 101Ω

9.

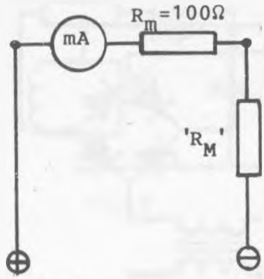


Fig.4

The basic moving coil meter shown in fig.4 has a FSD of 1mA and a resistance of 100Ω. What is the resistance of the multiplier 'R_M' when the meter has a FSD of 10 volts?

a) 99 Ω b) 10,100 Ω

c) 9,900 Ω d) 1,010 Ω

---

10. The sensitivity of a voltmeter is usually expressed in terms of-

a) volt amps. VA

b) volt watts.VW

c) ohms per watt. Ω /W

d) ohms per volt. Ω /V

---

11. Various voltmeter sensitivities are given below, which one will have the minimum effect on the circuit being measured?

a) 100Ω/V b) 1000Ω/V c) 10,000Ω/V d) 1MΩ/V

---

12. The moving coil instrument circuit shown below in fig.5 is suitable for the measurement of-

a) alternating voltages.

b) alternating currents.

c) resistance.

d) RMS power.

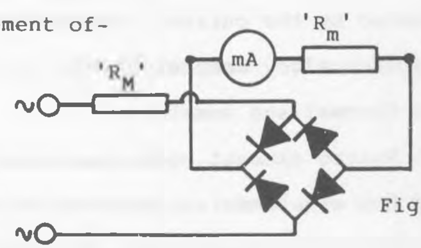


Fig.5

---

13. The scale of a moving coil a.c. instrument is normally calibrated to read-

a) the average value of a sinewave.

b) the RMS value of a sinewave.

c) the peak value of a sinewave.

d) the RMS value of any a.c. waveform.

14. The instrument shown in fig.6 has been designed for the measurement of-

a) alternating voltages.

b) alternating currents.

c) inductance and capacitance.

d) wattless power.

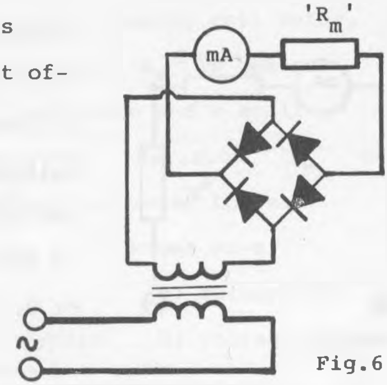


Fig.6

---

15. Fig.7 shows the moving coil instrument used in conjunction with device 'X' to enable it to measure RF currents. What is device 'X'?

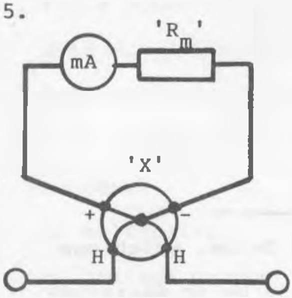


Fig.7

a) A magnetic coupler.

b) A cold cathode.

c) A bi-metallic sensor.

d) A thermo-couple element.

---

16. What type of instrument depends upon the expansion of a wire heated by the current flowing in it, for its deflection?

a) Iron alloy ammeter.

b) Thermal-sag ammeter.

c) Heated element voltmeter, d.c. or a.c. up to 5kHz.

d) Hot wire ammeter, d.c. to RF.

---

17. The type of meter which depends for its deflection upon the attraction or repulsion of a piece of iron under the influence of a magnetic field, is known as a-

a) moving iron ammeter.

b) magnetically coupled ammeter.

c) propulsion deflectometer.

d) moving coil galvanometer.

18.

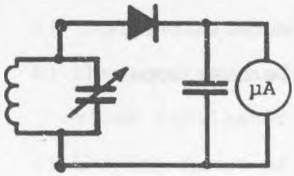


Fig.8

Fig.8 shows the circuit of a basic-

a) RF voltmeter.

b) RF power meter.

c) absorption wavemeter.

d) passive oscillator.

---

19. Referring to fig.8, what is this device suitable for?

    a) Accurate RF voltage measurement.

    b) Accurate RF power measurement.

    c) Coarse frequency checking, and testing for harmonic radiation.

    d) Generating calibration markers.

---

20. Referring to fig.8, what are the common uses for this device?

    a) Accurate power and frequency measurement.

    b) Checking for correct harmonic multiplication, spurious emissions and parasitic oscillation.

    c) VSWR and impedance measurement.

    d) Checking the accuracy of standard frequency transmissions.

---

21. Which instrument from those listed below, would you use to give an approximate indication of the resonant frequency of a non-energised tuned circuit?

    a) Grid dip oscillator (GDO) or FET dip oscillator.

    b) Digital frequency meter.

    c) RF spectrum analyzer.

    d) Peak reading power meter.

22. What is the name given to the type of instrument which beats the incoming signal with an accurate internal variable frequency oscillator to produce an audible beat note?

a) Heterodyne wavemeter.

b) Carrier dip detector.

c) Audible crystal calibrator.

d) Digital crystal calibrator.

---

23. What is one of the disadvantages of the instrument referred to in Q 22 above?

a) It will only measure high power transmitters.

b) Licences are no longer issued for the use of this device.

c) It will only operate below 2MHz.

d) The presence of harmonics and other spurious emmisions might give misleading results.

---

24. Calibration of the VFO of a heterodyne wavemeter is by means of-

a) the fundamental or harmonics of a 100kHz or 1MHz crystal oscillator.

b) a vernier scale volume control.

c) a calibrated antenna.

d) a thermal sensing element.

---

25. The digital frequency meter (DFM), commonly referred to as the frequency counter, is one of the most convenient instruments for frequency measurement, it is also-

a) one of the most complex instruments to use.

b) one of the least accurate.

c) one of the most accurate and easy instruments to use.

d) highly unreliable.

26. The accuracy of the digital frequency meter is dependent upon

   a) the precise mains frequency.

   b) the accuracy and long term stability of the internal clock oscillator.

   c) the impedance of the source being measured.

   d) the accuracy of the MSF signal to which it was initially adjusted.

---

27. The term, resolution, applied to the digital frequency meter refers to the-

   a) amount of overload it can tolerate.

   b) time taken to reset the instrument.

   c) maximum frequency that can be read.

   d) smallest division to which a reading can be taken.

---

28. The term, accuracy, applied to a digital frequency meter is-

   a) the difference between the measured reading and the true value.

   b) the smallest division to which a reading can be taken.

   c) the frequency difference between the clock oscillator and the signal being measured.

   d) both b and c above.

---

29. The oscilloscope timebase provides the-

   a) necessary voltage stabilization for the cathode ray tube.

   b) calibrated horizontal 'X' deflection.

   c) calibration voltage for the signal amplifier.

   d) calibrated vertical 'Y' deflection.

30. Deflection of the electron beam in a CRT is due to the-

a) timebase supply frequency.

b) accelerator anode voltage.

c) voltage on the deflector plates.

d) CRT heater current.

---

31. What is the purpose of the 'Y' amplifier in the cathode ray oscilloscope?

a) It provides the line flyback suppression.

b) It ensures that frequency calibration is maintained.

c) It produces the timebase deflection voltage.

d) It amplifies the input signal to give a suitable vertical deflection.

---

32. Referring to fig.9. From the lissajous figure shown, it can be seen that the unknown frequency is-

a) 50Hz   b) 150Hz

c) 300Hz   d) 450Hz

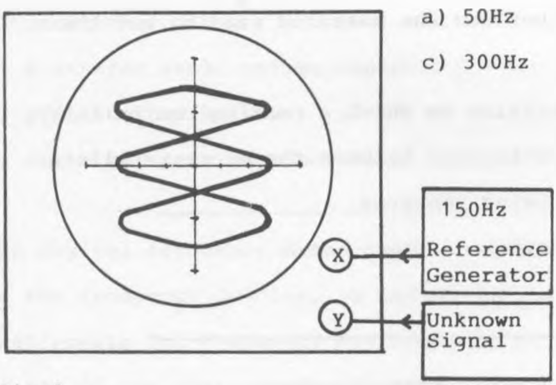


Fig.9

---

33. The answer to Q 32 above represents a frequency ratio of-

a) 3 : 1   b) 2 : 1   c) 1 : 1   d) 1 : 2

34.

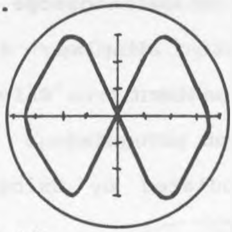


Fig.10

Referring to fig.9. With the reference frequency set to 150Hz, the lissajous figure shown in fig.10 is displayed. What is the unknown signal frequency?

a) 50Hz b) 150Hz

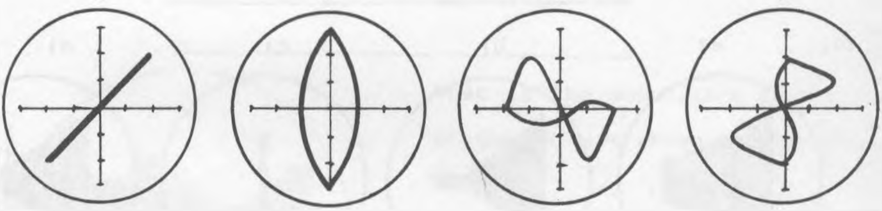
c) 300Hz d) 450Hz

35. The answer to Q 34 above represents a frequency ratio of-

a) 3:1 b) 1:1 c) 1:2 d) 1:3

36. Referring to fig.9. Both X and Y signals are of the same frequency and phase. Which one of the lissajous figures shown below will be displayed?

a b c d



37. The lissajous figure shown in fig.11, indicates that the two signals are of equal frequency-

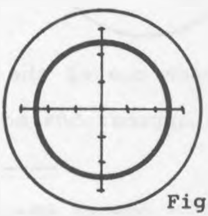


Fig.11

a) with no phase difference.

b) and vary in phase.

c) and have a phase difference of either 90° or 270°.

d) and have a phase difference of 180°.

38.

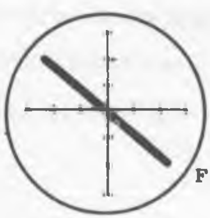


Fig.12

Which one of the answers in Q 37 above suits the lissajous figure shown in fig.12?

39.

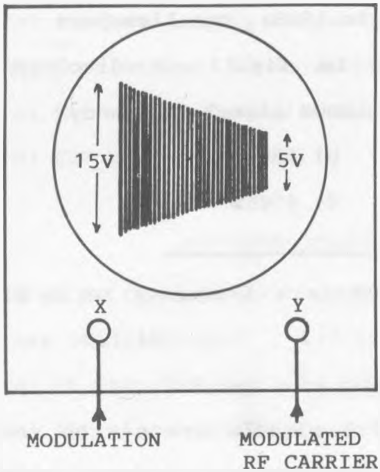


Fig.13

Fig.13 shows an oscilloscope connected to display a trapezoidal pattern from which the modulation percentage can be calculated by using the formula:-

$$M = \frac{Emax - Emin}{Emax + Emin} X\ 100\%.$$

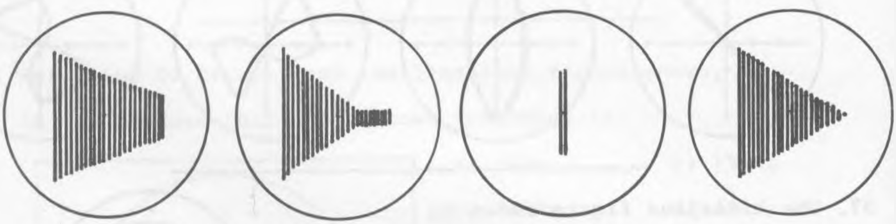
What is the modulation percentage of the pattern shown on the oscilloscope?

a) 15% b) 33%

c) 50% d) 66%

---

40. a) b) c) d)



Which one of the trapezoidal patterns shown above is typical of approx: 50% modulation?

---

41. Which one of the trapezoidal patterns shown above is typical of an over-modulated AM transmission?

---

42. Which one of the trapezoidal patterns shown above is that of an AM transmission with 100% modulation?

---

43. Which one of the trapezoidal patterns shown above is typical of a transmission with no modulation?

44. The modulation percentage of an AM transmission can be calculated by measuring the level of the unmodulated carrier 'A', and the peak level of the modulated carrier 'B', and applying the formula:-

$$M = \frac{B - A}{A} \times 100\%.$$

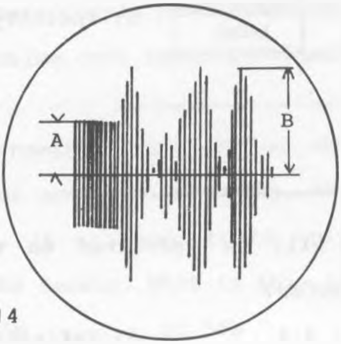


Fig.14

Referring to fig.14. The carrier wave is 10 volts and modulation peaks are 20 volts. What is the percentage modulation?

a) 33%   b) 50%

c) 66%   d) 100%

45.

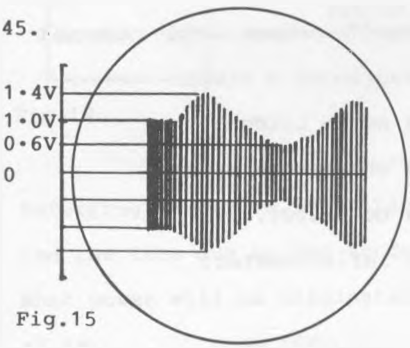


Fig.15

What is the modulation depth of the AM wave shown in fig.15?

a) 40%

b) 50%

c) 66%

d) 70%

---

46. Which one of the instruments listed below is suitable for measuring the carrier power of an AM or FM transmitter?

a) Absorption wavemeter.

b) Directional RF wattmeter.

c) Heterodyne frequency meter.

d) Dip oscillator.

47. Referring to fig.16. What Voltage Standing Wave Ratio (VSWR) would you expect to be indicated on the VSWR meter?

a) 1:1

b) 2:1

c) 3:1

d) Infinity.

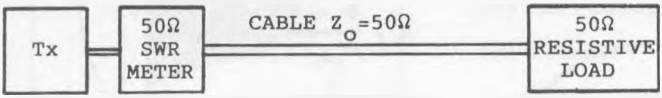


Fig.16

---

48. Referring to fig.16. What VSWR will be indicated on the VSWR meter if the load is disconnected?

a) 1:1 b) 2:1 c) 3:1 d) Infinity.

---

49. Fig.17 shows the circuit diagram of a simple-

a) noise bridge.

b) wheatstone bridge.

c) bolometer.

d) reflectometer.

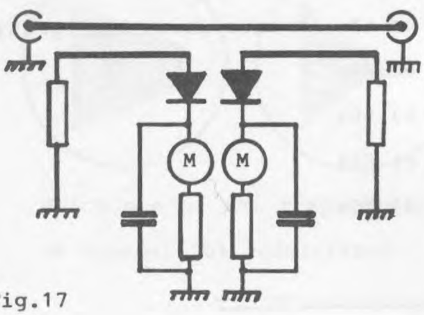


Fig.17

---

50. Referring to fig.17. Which one of the following statements is true when the meter is used for power measurement?

a) The calibration of the instrument varies with frequency.

b) The calibration is independent of frequency.

c) The instrument is not suitable for VHF use.

d) The instrument is not accurate above 50 watts.

51. Which instrument from the list below, is suitable for accurate and frequency independent power measurement at frequencies up to 500MHz and above?

a) Heterodyne wavemeter.

b) Absorption wavemeter and dummy load.

c) Thermocouple power meter.

d) Moving coil rectifier instrument.

---

52. A transmitter connected as shown in fig.18 below, has an output power of 10 watts. When the power is measured at the load, it is found to be only 2 watts, this is due to loss in the feeder. What is this loss?

a) 3dB   b) 5dB   c) 7dB   d) 20dB

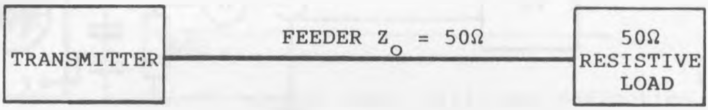


Fig.18

---

53. Referring to fig.18. The transmitter output power is 100 watts, and the loss due to the feeder is 10dB.

What power will be dissipated in the load?

a) 1W   b) 10W   c) 100W   d) 200W

---

54. A two tone test oscillator for the alignment of a single-sideband transmitter must provide-

a) two harmonically related audio frequency tones.

b) two non-harmonically related audio frequency tones.

c) two harmonically related radio frequency signals.

d) two non-harmonically related radio frequency signals.

55. Fig.19 shows the RF output waveform of a-

Fig.19

a) FM transmitter, slightly over-deviated.

b) CW transmitter with very fast keying.

c) SSB transmitter with a single tone test signal applied.

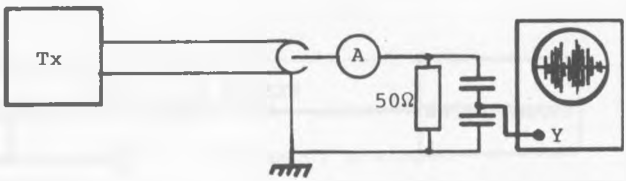
d) SSB transmitter with a two tone test signal applied.

---

56. The RF output current of a multimode transmitter switched to the CW mode is 1 amp. This is measured on a thermocouple ammeter connected to a 50Ω dummy load, see fig.20 below. What is the output power?

a) 1W b) 25W c) 50W d) 150W

Fig.20



---

57. Referring to fig.20 and Q 56. What is the peak voltage across the 50Ω dummy load?

a) 14·4V b) 50V c) 70·7V d) 141·4V

---

58. Referring to Q 56 and 57. The peak RF voltage of the transmitter in the CW mode causes a 5cm deflection on the screen of the oscilloscope. When the transmitter is switched to the SSB mode the peaks on the screen due to speech cause a deflection of 7·5cm. What is the peak envelope voltage?

a) 50V b) 70·7V c) 106V d) 150V

---

59. Referring to Q 58. The peak envelope power (PEP), is-

a) 70·7W b) 149W c) 225W d) 400W

60. The output of a SSB transmitter is connected as shown in fig.20. With no audio input applied to the transmitter, what RF output voltage will be measured on the oscilloscope?

a) Zero. b) 0·707V. c) 1.414V. d) 2·82V.

---

61. A single audio tone is applied to the input of a SSB transmitter, which is connected as shown in fig.20. The measured output power is 100 watts (RMS), which produces a 2cm deflection on the oscilloscope screen.
What is the power dissipated in the dummy load when a second and non-harmonically related tone of equal amplitude to the first is applied to the transmitter?

a) Zero. b) 141·4W. c) 200W. d) 400W.

---

62. Referring to Q 61 above. What will the deflection on the CRO screen increase to, when the two audio signals are applied to the transmitter input?

a) 2·66cm. b) 2·82cm. c) 4·0cm. d) 5·0cm.

---

63. Referring to Q 61 and 62 above, the two audio tones are removed, a speech signal is applied and its level adjusted so that the RF modulation peaks observed on the CRO screen are equal to the maximum deflection caused by the two tone test signal. What is the Peak Envelope Power of the RF output signal?

a) 14·4W. b) 141·4W. c) 200W. d) 400W.

17. MEASUREMENT

1	a	16	d	31	d	46	b
2	c	17	a	32	a	47	a
3	a	18	c	33	a	48	d
4	d	19	c	34	c	49	d
5	b	20	b	35	c	50	a
6	a	21	a	36	a	51	c
7	b	22	a	37	c	52	c
8	b	23	d	38	d	53	b
9	c	24	a	39	c	54	b
10	d	25	c	40	a	55	d
11	d	26	b	41	b	56	c
12	a	27	d	42	d	57	c
13	b	28	a	43	c	58	c
14	b	29	b	44	d	59	c
15	d	30	c	45	a	60	a
						61	c
						62	b
						63	d

18. SAFETY

1. Safety at the amateur station is the responsibility of the-

   a) Amateur himself.

   b) R.S.G.B.

   c) Radio Regulatory Authority.

   d) Local Electricity Authority.

---

2. Safety inspections of amateur radio stations-

   a) are the responsibility of the amateur.

   b) are carried out at regular intervals by the Radio Regulatory Authority.

   c) take the form of a six-monthly questionaire which has to be returned to the R.S.G.B. on completion.

   d) are carried out by the Local Electricity Authority at regular twelve monthly intervals.

---

3. Any voltage should be considered dangerous, particularly when it is above-

   a) zero   b) 13·8V   c) 50V   d) 230V

---

4. It is advisable that the mains power entering the amateur radio station is controlled by-

   a) one two pole switch for each item of equipment.

   b) one 30 Amp fuse that can be easily blown by throwing a shorting switch.

   c) a separate toggle switch on each piece of equipment.

   d) one master switch, easily identified, which can isolate the power to the radio station.

5. If you walk into an amateur radio station and find the amateur unconscious on the floor, and apparently in contact with live mains equipment, you should-

   a) grab hold of him and lay him on a rubber mat.

   b) stand yourself on a rubber mat and gently pull him away from the live equipment.

   c) stand on a rubber mat, switch the CB to channel 9 and put out a 10-33, because more people are prepared to answer a 10-33 than a CQ.

   d) first turn the mains off at the master switch, and then take any action deemed necessary.

---

6. All radio station wiring should be-

   a) cotton insulated with a current carrying capacity of at least 1 Amp.

   b) enclosed in a RF screen.

   c) adequately insulated and have sufficient current carrying capacity.

   d) of the co-axial type.

---

7. It is recommended that all radio and test equipment is correctly-

   a) fireproofed.

   b) waterproofed.

   c) airtight.

   d) earthed.

8. Before repairing any item of mains powered equipment-

a) it should first be stood on a rubber mat.

b) you should first stand on a rubber mat.

c) it should first be disconnected from the mains supply.

d) set the lowest voltage possible on the mains input adjustment panel.

---

9. When working on, or handling radio equipment that has been switched off or disconnected, it is possible to receive a severe electric shock from the-

a) valve heaters.

b) charged field around the P.A. coil.

c) charged field around the transistors.

d) charged capacitors, particularly those in the PSU.

---

10. It is normal practice to discharge high voltage capacitors by

a) short-circuiting them with a large toggle switch.

b) switching a lower value capacitor in series with them.

c) fitting a 'bleed resistor' in parallel with them.

d) fitting a 'bleed resistor' in series with them.

---

11. As an additional precaution, when working on equipment containing high voltage capacitors, one should-

a) remove all the equipment fuses.

b) fully discharge all the capacitors by means of an earthed probe with an insulated handle.

c) fully discharge all the capacitors by shorting them with a silicon diode inside an insulated tube.

d) solder a piece of wire across the capacitors to ensure that they discharge.

12. When low-leakage capacitors are stored, you should-

a) pack them in a dry cardboard box.

b) wrap their terminals with insulating tape.

c) store them in a damp atmosphere.

d) short circuit their terminals.

---

13. In order to indicate that your equipment is live, you should-

a) fit a power output meter.

b) make sure that it has suitable indicator lamps fitted.

c) mount a thermometer on the transformer.

d) fit a transformer with noisy laminations.

---

14. If your transmitter fuse keeps blowing, and it is of the recommended value, you should-

a) disconnect the transmitter from the mains and check for a fault.

b) gradually increase the rating of the fuse until you are able to find one of a suitable value.

c) replace the fuse with something like a nail, and allow the fault to burn itself out.

d) reduce the rating of the fuse, it may be rated too high for the application.

---

15. Before you change a fuse, you should-

a) discharge the capacitors.

b) switch off the equipment.

c) disconnect the antenna.

d) short circuit the mains supply.

16. When constructing equipment which uses high voltages, it is good practice to-

a) use low voltage fuses.

b) use thermal delay fuses.

c) fit micro-switches so that when any cover exposing high voltages is removed, the supply is disconnected.

d) design a built-in SWR meter.

---

17. The recommended mains switches for amateur equipment are-

a) double pole types.

b) single pole types.

c) insulated gate types.

d) screened dipole types.

---

18. If it is absolutely necessary to work on live equipment, you should ensure that-

a) no part of your body is in contact with live or earthed metalwork, that you are standing on a dry rubber mat and that you keep one hand in your pocket to prevent you making a complete circuit by accident.

b) there is a 500Ω resistor connected in the mains live wire.

c) all 'bleed resistors' are removed.

d) you have had a recent medical by a BMA approved doctor.

---

19. When working on live equipment in a room with a concrete floor, you should ensure that-

a) the correct fuses are fitted.

b) the equipment has a mains transformer.

c) there is enough light to see the diagram.

d) you stand on a dry rubber mat, keep one hand in pocket and use insulated tools.

20. Antennas should not be-

a) higher than 50 feet above sea level.

b) lower than 20 feet below sea level.

c) fed with more than 99 watts of RF power.

d) allowed to come into contact with mains or d.c. voltages.

21. When transmitter h.t. voltages are decoupled from the feeder and antenna by the use of capacitors-

a) a fuse must be fitted in the feeder.

b) a neon light must be fitted at the tip of the antenna.

c) a d.c. path to earth must be provided on the feeder side of the capacitor, usually by means of an RF choke.

d) the tip of the antenna should be grounded to RF currents by means of detector diodes.

22. A fuse should be fitted in the 12V supply from a car battery as close to the battery as possible, because a fault developing on the supply lead might-

a) electrocute all the occupants in one go.

b) jam aircraft beacons if you drive within half a mile of an airport.

c) set the car on fire.

d) cause premature rusting, especially on imported models.

23. You must not transmit near quarries where-

a) heavy lorries are crossing.

b) the earth moving vehicles are radio controlled.

c) quartz is being quarried.

d) electrically detonated charges are being used.

24. When making adjustments on live equipment you should never-

a) wear headphones or use both hands on the equipment.

b) wear rubber boots and nylon socks because of the static.

c) drink high conductivity liquids, such as lager.

d) leave it connected to a radio frequency power meter.

---

25. For the measurement of high voltage circuits, you are warned not to use-

a) electronic voltmeters.

b) spark-gap voltmeters.

c) meters with metal zero adjusting screws.

d) any of the above.

---

26. Equipment installed in a car should be in such a position that in the event of an accident it-

a) does not injure the occupants of the car.

b) can be removed easily to prevent further damage.

c) can still be operated to call an ambulance.

d) blows all its fuses.

---

27. When the operator is driving, he should not use a

a) loudspeaker other than the one in the transceiver.

b) screened microphone cable.

c) hand microphone.

d) cassette player at the same time as the transceiver.

---

28. A piece of radio equipment is rated 250 watts at 250 volts. What is a suitable fuse value for the mains supply?

a) 500mA. b) 750mA. c) 2A. d) 13A.

29. You should switch off your radio equipment-

a) at a petrol station or near fuel tanks.

b) when on mountain roads in case you overturn the vehicle and the radio causes a fire.

c) when you spot a radar speed trap, as it might prevent you from being booked.

d) when you are close to a fire station.

---

30. Mobile QSOs should be logged-

a) as soon as the QSO commences.

b) as soon as practicable after the end of the journey.

c) when travelling, it is normal practice to have a small log pad strapped to the drivers leg.

d) before the end of each month.

---

31. One often overlooked cause of danger is-

a) worn rubber feet on old equipment.

b) grey paint used on ex-services equipment.

c) live spindles with metal screws holding the knobs on.

d) the light emission from LED displays.

---

32. Metal cases of morse keys and microphones etc: should be-

a) connected to the nearest gas supply pipe.

b) connected to the earthed chassis or case of the equipment with which they are associated.

c) wrapped in fairly thick plastic bags to prevent contact by the operator.

d) left unearthed.

33. You are about to fit a new antenna to the side of your house and will be working from a ladder; your first duty will be to-

a) assemble the antenna on the ground.

b) ensure that the cable fixings will not cut the coax.

c) tie the ladder at the top and bottom before working from it.

d) check the VSWR of the antenna.

---

34. Because of its high thermal conductivity, high resistivity and low dielectric loss, Beryllium oxide is sometimes used in the construction of power transistors, heat sinks and dummy loads. These devices should not be-

a) used in a low temperature environment.

b) used at frequencies above 200 MHz.

c) broken, filed or ground to produce dust.

d) purchased without a special licence.

---

35. Damaged or broken devices which are known to contain Beryllia should be-

a) sealed in polythene bags and disposed of in accordance with the equipment or device manufacturers instructions.

b) thrown in your nearest water filled gravel pit.

c) immersed in hot salt water and buried locally.

d) neutralized in a strong RF field and thrown in the dustbin.

18. SAFETY

1	a	21	c
2	a	22	c
3	c	23	d
4	d	24	a
5	d	25	c
6	c	26	a
7	d	27	c
8	c	28	c
9	d	29	a
10	c	30	b
11	b	31	c
12	d	32	b
13	b	33	c
14	a	34	c
15	b	35	a
16	c		
17	a		
18	a		
19	d		
20	d		

19. OPERATING PRACTICES & PROCEDURES

1. Before calling CQ on any frequency it is advisable to-
   a) tune the transmitter to the antenna without the use of a dummy load.
   b) key-up the carrier for three minutes to clear the channel.
   c) ensure that all signals on the frequency that you propose to use are below S9.
   d) listen on the proposed operating frequency first.

---

2. When beginning to establish a long distance CW call one should first-
   a) hold the key down for a period of about three minutes to clear the frequency.
   b) if possible, set-up an automatic call sender and leave it sending CQ for at least five minutes and then announce your call-sign.
   c) send, after first listening your frequency-
      CQ CQ CQ K K K GM3--- CQ K CQ K
   d) send, after first listening your frequency-
      CQ CQ CQ DE GM3--- GM3--- GM3--- K

---

3. Referring to Q 2 above, why is the K sent?
   a) It invites Kentish stations only to reply.
   b) It invites any station to reply.
   c) It informs receiving stations that the message has been sent correctly.
   d) It announces that there is another CQ to follow.

4. When sending messages by morse telegraphy, the procedure signal for wait is $\overline{AS}$. What does the line above the A and the S mean?
   a) That you have just sent AS incorrectly.
   b) That the message is for American stations only.
   c) That the message is for Amateur stations only.
   d) That the individual letters are sent as one, with no space between them.

---

5. When sending messages by morse telegraphy, it is inadvisable to-
   a) change your notepad in the middle of a QSO.
   b) send perfect morse, this will confuse morse reading machines.
   c) use a suppressed morse key.
   d) send at a speed greater than you are able to receive.

---

6. When attempting to establish a long distance (Dx) telephony contact on the HF bands it would be considered reasonable procedure to-
   a) repeat CQ Dx for five minutes followed by your call-sign.
   b) give your call-sign first then call CQ Dx for five minutes
   c) call 'CQ Dog Xray' for 10 seconds, listen for 10 seconds, and repeat until somebody replies.
   d) call CQ Dx three or four times followed by your call-sign and listen for a reply, repeat if necessary.

7. What is the Q code?

a) A series of internationally agreed questions and answers.

b) A series of mandatory RSGB agreed operational status reports.

c) An easy to remember series of UK/European status codes.

d) An internationally agreed code which ensures secrecy over long distance radio links.

---

8. The international Q code for static interference and interference caused by electrical machines is-

a) QRM   b) QRN   c) QSO   d) QSL

---

9. The international Q code for interference caused by adjacent radio transmissions is-

a) QRM   b) QRN   c) QSO   d) QRT

---

10. You have just received a report of severe QSB from a station you are in contact with, what does it mean?

a) That the distant station is receiving static interference.

b) That the distant station is reducing his power.

c) That your signals are suffering severe fading.

d) That the neighbours have just requested the distant station to close down due to severe television interference.

---

11. The international Q code for reducing power is-

a) QRN   b) QRT   c) QRP   d) QSY

---

12. If you requested a distant station to QRO would he-

a) change frequency.   b) reply with the time.

c) close down.   d) increase power.

13. If you are in contact with a station that is sending faster than you are able to read, you should-

a) look up his address in the call book, get his telephone number from directory enquiries, phone him ASAP as he may be causing TVI due to his keying speed.

b) reduce your BFO frequency to slow down the received transmission rate.

c) plug in the microphone and tell him to slow down.

d) send the Q code QRS.

---

14. An RST report gives the receiving stations assessment on-

a) Readability, Strength and Carrier wave frequency.

b) Rig, Signal and Twig.

c) Readability, Signal strength and Time.

d) Readability, Signal strength and Tone.

---

15. You receive a report that your telephony transmission is 5 and 9, what does this imply to you?

a) That your signal is strength 5 and your readability is graded 9 on a quality scale.

b) That your readability is graded 5 on a quality scale 1 - 5, and your signal is graded 9 on a strength scale 1 - 9.

c) That your signals are very low and unreadable.

d) That the static interference is strength 5, and the readability is reduced to strength 9.

---

16. The recommended 'phonetic' spelling for the word 'STAR' is-

a) Sierra Tango Alpha Roger.

b) Sierra Texas Alpha Romeo.

c) Sugar Tango Alpha Romeo.

d) Sierra Tango Alpha Romeo.

17. In order that a reasonable degree of harmony may be experienced by all amateurs operating in the amateur bands, it is advisable to-

a) stick rigidly to ones rights.

b) observe any recommended band plan for the band in which you intend to operate.

c) demand that any high power stations operating in your neighbourhood close down while you are transmitting.

d) ensure when possible that all your A.M. transmissions are overmodulated, and that all of your F.M. transmissions are overdeviated.

---

18. When using telephony on any frequency band,and conditions are poor, it may be necessary to-

a) reduce transmitter power.

b) insert an attenuator in your receive antenna in order to reduce the noise levels.

c) spell words using the phonetic alphabet.

d) check that the 'low pass filter' is fitted.

---

19. To use an amateur repeater, one first has to-

a) access it by the prescribed method for that particular repeater, which could be a tone burst or a carrier wave.

b) be a member of the RSGB.

c) obtain an additional licence from the regulatory authority.

d) access it by sending GA in morse code.

20. The advantage of using a repeater is that-

a) secrecy is maintained between the participants of the QSO.

b) general broadcasts to all amateurs and from any amateur may be made on the repeater.

c) once accessed, the superior coverage of the repeater is extended to any amateur able to access it.

d) it may be used for passing business messages over wide areas.

---

21. It should be remembered that amateur repeaters are paid for and maintained-

a) out of RSGB funds.

b) by the Radio Regulatory Authority.

c) by subscriptions from members of local repeater groups.

d) by British Telecom.

19. OPERATING PRACTICES & PROCEDURES

1	d	12	d
2	d	13	d
3	b	14	d
4	d	15	b
5	d	16	d
6	d	17	b
7	a	18	c
8	b	19	a
9	a	20	c
10	c	21	c
11	c		

20. LICENSING CONDITIONS

1. The applicant for an Amateur Licence A or B must be over the age of-

   a) 18 b) 16 c) 14 d) 12

---

2. The applicant for an Amateur Licence B must have-

   a) passed the Radio Amateurs Examination.

   b) passed the morse test.

   c) gained full membership of the RSGB.

   d) passed the Radio Amateurs Examination and the morse test.

---

3. The applicant for an Amateur Licence A must have-

   a) passed the Radio Amateurs Examination.

   b) passed the morse test.

   c) full membership of the RSGB.

   d) passed the Radio Amateurs Examination and the morse test.

---

4. Does the applicant for an Amateur Licence A have to be a British Subject?

   a) No.

   b) Yes.

   c) Yes, but normally applicants from the Irish Republic will be considered.

   d) Yes, but consideration will be given to holders of an international driving licence.

---

5. For the purpose of obtaining a licence, a success in the morse test will remain a valid qualification for a period of-

   a) 6 months. b) 1 year. c) 2 years. d) 10 years.

6. The morse test requires that the candidate is able to send and receive in plain language, 36 words (averaging 5 letters per word) in-

a) 1 minute. b) 2 minutes. c) 3 minutes. d) 36 minutes.

---

7. The Amateur licence B does not at present authorise the use of frequencies below-

a) 27 MHz b) 30 MHz c) 70 MHz d) 144 MHz

---

8. The licensee of an Amateur Radio Station may use the station for the purpose of sending to, and receiving from, other licensed amateur stations-

a) as part of the self training of the licensee in communication by wireless telegraphy.

b) in order to re-transmit general emergency and assistance messages.

c) as part of a National Radio Relay Service.

d) at the request of the local Port or Harbour Authority during disaster relief operations.

---

9. The licensee of an amateur radio station may use the station to-

a) relay messages as part of an amateur relay chain.

b) re-transmit general emergency and assistance messages.

c) pass messages during disaster relief operations conducted by the Emergency County Planning Officer.

d) assist British Telecom in event of a main cable failure.

10. As the holder of an Amateur Licence B, you wish to receive transmissions of the Standard Frequency Service, you should-

a) go ahead and make use of the service.

b) switch off and not use the service in case you are detected.

c) wait until an Amateur Licence A holder is present.

d) obtain special permission from the Secretary of State.

---

11. Do the terms of the Amateur Licence in any way authorise the amateur to transmit business messages?

a) No.

b) Yes.

c) Yes, but only when the messages are coded.

d) Yes, with the approval of the local Head Postmaster.

---

12. The holder of an Amateur Licence wishes to carry out simple range tests from the top of St. Pauls Cathedral using a handportable transceiver on a frequency of 144·750 MHz. What should he do?

a) Demand access at any reasonable time in the interest of science and his self training.

b) Make a donation to Cathedral funds and go ahead.

c) Seek permission from the person responsible for the administration of the building.

d) Remember that the licence does not cover use from public or private buildings.

13. A passenger holding an Amateur Licence B is on a domestic flight over Northern Ireland. If he wishes to use a 2 metre transceiver, he should-

a) use the prefix GI and the suffix /P.

b) use the prefix GI and the suffix /M.

c) on receipt of the captains permission, use the call sign as in answer a) above.

d) forget the idea, it is not permitted.

---

14. Can a portable amateur radio station be established and used on a public transport vehicle?

a) No.

b) Yes, in any emergency.

c) Yes, providing operation is restricted to repeaters only.

d) Yes, with the permission of the Minister of Transport.

---

15. At a temporary premises the correct suffix to be added to a stations call sign is-

a) '/T' b) '/M' c) '/P' d) '/A'

---

16. At a temporary location, or as a pedestrian, the suffix to be added to a stations call sign is-

a) '/T' b) '/M' c) '/P' d) '/A'

---

17. A climber with an Amateur Licence A is operating a portable transceiver from the top of Ben Alder in Scotland. Which one of the following call signs would be valid?

a) GM8---/P b) GS3---/A c) GM3---/P d) GM4---/M

18. The holder of an Amateur Licence B is in a small boat which springs a leak in the middle of Loch Ericht. Is he permitted to transmit his status to a '/A' station on the bank?

a) No.

b) Yes, providing he uses a '/M' on his call sign.

c) Yes, providing he uses a '/MM' on his call sign.

d) Yes, providing the '/A' station is able to work on the international distress frequencies.

---

19. A visitor to England from the Channel Isles, has a home call sign GJ1--- What call sign will he use when mobile and driving through the county of Kent?

a) GJ1---/M b) GE1---/P c) G1---/M d) GJE---/P

---

20. A mobile station from the North of England, G8---/M, when visiting the Isle of Man will use the call sign-

a) GM8---/M b) G8M---/M c) GD---/M d) GD8---/M

---

21. During a period of prolonged transmission you must-

a) send your station call every 5 minutes.

b) repeat your call every 360 seconds.

c) send your station call at the begining, end, and every 15 minutes of transmission.

d) send your station call sign every 10 minutes.

---

22. When is it necessary for an amateur to sign and enter his/her call sign in a station log?

a) When an Amateur Licence B holder has used the HF bands to deal with an emergency.

b) When operating from a cross channel ferry.

c) When using a commercial broadcast station.

d) When operating another licensee's station.

23. When an Amateur Licence A or B has expired or been revoked, it should be-

a) destroyed immediately.

b) returned to the Secretary of State.

c) passed on to a responsible person for retention.

d) returned to the General Manager of British Telecom.

---

24. The Amateur Licence A and B may be revoked or have its terms varied by the publication of a notice in-

a) a newspaper published in London, Edinburgh and Belfast.

b) every Town Hall window.

c) the BBC Radio Times.

d) page 3 of the Sun newspaper because most amateurs refer to it daily.

---

25. Who should be notified when the correspondence address of a Licensee changes?

a) The General Manager of British Telecom H.Q.

b) The Postmaster General.

c) The Radio Society of Great Britain.

d) The Secretary of State.

---

26. When should the person referred to in Q 25 above be notified of a change in correspondence address?

a) Within one month of moving residence.

b) When the licence is renewed.

c) Promptly.

d) Two weeks in advance of a change of address.

27. If wireless telegraphy apparatus is used, which is not in accordance with the terms of the licence granted by the Secretary of State, it could result in-

a) the licence being revoked.

b) the licence being revoked and the offender prosecuted.

c) the RAE being revoked and the licence fee refunded.

d) the licence being endorsed and the offender disqualified.

---

28. Who can demand that an amateur radio station closes down?

a) The local postman.

b) The local Head Postmaster.

c) A police superintendent from Scotland Yard.

d) A person acting under the authority of the Secretary of State.

---

29. When an oral demand has been received to close down an amateur station, it will be-

a) confirmed in writing.

b) confirmed in writing within 7 days.

c) announced in the local press.

d) backed up by a second visit from a person acting under the authority of the Secretary of State.

---

30. In a national emergency, who can demand that you close down your amateur radio station?

a) The General Manager of British Telecom H.Q.

b) The owner of a local amateur radio shop with an announcement over the local repeater.

c) A person acting under the authority of the Secretary of State.

d) Anybody.

31. If the holder of an Amateur Licence A or B wishes to establish and operate a station at an alternative premises in England, he must-

a) give 7 days notice in writing to the General Manager of the British Telecom area in which the station is to be situated.

b) give 14 days notice to the Secretary of State.

c) give 28 days notice to the Secretary of State.

d) do nothing, no action is required.

---

32. Referring to gaps between entries in a station log-

a) there should be no more than 1 gap per 10 entries.

b) there should be no gaps.

c) gaps should be left at random to enter forgotten calls.

d) a gap should be left at the start of each period of operation.

---

33. The entries in a station log must include-

a) date and local time.

b) signature of licensee and distance of transmission path.

c) date and time in GMT of commencement and end of period of operation.

d) comments on transmission and power of transmitter.

---

34. A separate log book may be kept for pedestrian or mobile use, the entries must include-

a) the time in BST, vehicle registration number and frequency.

b) date, geographical area of operation, frequency bands used and time of start and end of journey (GMT).

c) date, stations worked and transmitter power.

d) exact frequency of operation, class of emission and local time.

35. A local amateur has had his licence revoked. Is it permissible for you to discuss his personal facts with other licenced amateur stations on the 70cm band?

a) No.

b) Yes.

c) Yes, but only when the messages are coded.

d) Yes, when it is reasonable to believe that no other stations are listening.

---

36. Gramophone or tape recordings meant for entertainment may-

a) only be transmitted after BBC radio broadcasts are over for the day.

b) only be transmitted during national emergencies to inform others that the channel is in use.

c) only be transmitted for test purposes providing that they are logged and comform to CCIR recommendations.

d) not be transmitted at all.

---

37. When an amateur with whom you are in contact records your transmission, he may-

a) remove your call sign and re-transmit it to your station only.

b) use the recording as a general purpose test transmission.

c) only listen to it in the privacy of his own home.

d) re-transmit it with your call sign to your station only.

---

38. Recordings of special audio frequency tones may be transmitted-

a) at any time.

b) only during a national emergency.

c) only as a calling signal for mobile stations.

d) only to activate or access VHF repeaters.

39. All apparatus comprising the station shall-

a) conform to the Secretary of State's specification CB 27/81.

b) conform to FCC regulations and BS 8000.

c) be capable of receiving transmissions in the Standard Frequency Service.

d) be designed, constructed, maintained and used so as to cause no undue interference with any wireless telegraphy.

---

40. Apparatus used for amateur transmitting shall-

a) comform to specification CB 27/81 and also BS 8000.

b) normally cause no undue interference, but allowances will be made at the discretion of the Secretary of State.

c) cause no undue interference.

d) have all spurious output signals suppressed to a level of at least 60dB below the carrier wave.

---

41. When an oral demand is received to close down an amateur station proved to be causing interference, it will be made by -

a) the General Manager of the local BT HQ.

b) a person acting under the authority of the Sec. of State.

c) the complainant in person with one witness.

d) the complainant accompanied by a person acting under the authority of the Secretary of State.

---

42. An oral demand to close down an amateur station which is causing interference will be-

a) confirmed in writing.

b) confirmed in writing within 7 days.

c) confirmed in writing within 14 days.

d) followed by a prosecution.

43. What method of frequency control shall be employed in the sending station apparatus?

a) A frequency synthesiser.

b) A calibrated GDO.

c) A 1MHz quartz crystal oscillator.

d) A satisfactory method.

---

44. When telegraphy (as distinct from telephony) is being used, attention must be given to a certain type of interference which is caused by-

a) oscillator drift.

b) buffer amplifier radiation.

c) resonance in the LPF.

d) keying the transmitter.

---

45. At all times, every precaution should be taken to avoid-

a) low modulation.

b) over-modulation.

c) narrow deviation.

d) the use of CW.

---

46. The station operator should ensure that the radiated energy is kept within the narrowest possible frequency band, having regard for the class of emission in use. For an A3E DSB telephony transmission in the VHF band, the range of modulating frequencies should be restricted to approx:-

a) 3kHz b) 6kHz c) 10kHz d) 15kHz

---

47. The radiation of harmonics and other spurious emissions shall be suppressed-

a) to a level of 60dB below the carrier.

b) to a level of 6dB below the carrier.

c) by means of a band pass filter in the transmitter output.

d) so as to cause no undue interference with any wireless telegraphy.

48. When operating a station near the edge of a band, an allowance must be made for-

a) harmonic radiation, and the effects of the low pass filter.

b) the position of the main lobe of the antenna.

c) the scattering of the signal in the ionosphere.

d) transmission bandwidth and oscillator drift.

---

49. Which one of the instruments listed below is suitable for checking that a VFO controlled transmitter is operating on its correct frequency?

a) A wavemeter based on a crystal oscillator.

b) An absorption wavemeter.

c) A dip oscillator.

d) A variable frequency oscillator.

---

50. Which of the instruments listed below would be suitable for checking that a crystal controlled transmitter is operating on its correct harmonic?

a) A RF power meter and dummy load.

b) An absorption wavemeter.

c) A dip oscillator.

d) Both a) and c) above.

---

51. The frequency coverage of an absorption wavemeter must-

a) extend up to the 10^{th} harmonic of the radiated frequency.

b) be accurate to within 0·0001% of the radiated frequency.

c) extend up to the 2^{nd} and preferably the 3^{rd} harmonic of the radiated frequency.

d) cover all possible harmonics of the radiated frequency.

52. You wish to transmit on a frequency of 21·225MHz, but your measuring instrument only has an accuracy of ± 1%.

Between which two limits might your transmission fall?

a) 21·01275 and 21·43725 MHz

b) 21·20378 and 21·24623 MHz

c) 21·00012 and 21·00437 MHz

d) 21·00001 and 21·00043 MHz

---

53. The instrument referred to in Q 52 is not of sufficient accuracy to allow you to operate other than near the centre of the 21 MHz band, so you obtain a frequency meter with an accuracy of ± 0·05%. Between which two limits might your transmission fall when you set up on a frequency of 21·020MHz ?

a) 21·33033 and 21·66066 MHz

b) 21·00300 and 21·00600 MHz

c) 21·00949 and 21·03051 MHz

d) 21·09490 and 21·30555 MHz

---

54. Referring to Q 53. Your carrier frequency might now be-

a) 9·49kHz outside your lower band edge.

b) 9·49kHz inside your lower band edge.

c) 20kHz inside your upper band edge.

d) 20kHz outside your upper band edge.

---

55. The Amateur Licence requires that tests for harmonics and other spurious emissions are made-

a) once a month and entered in the station log.

b) before each period of operation.

c) upon demand from a person acting under the authority of the Secretary of State.

d) from time to time and entered in the station log.

56. If living a certain distance (X) from an aerodrome, the height of your antenna must not exceed (Y) feet.

a) 1 mile --- 100ft. b) 5 miles --- 50ft.

c) 0·5 mile-- 50ft. d) 0·25 mile-- 50ft.

---

57. When a call sign is sent by morse telegraphy, its speed should not be greater than-

a) 6 WPM. b) 12 WPM. c) 20 WPM. d) 40 WPM.

---

58. When a station is sending messages by radio teleprinter (RTTY), the code used should be International Telegraph Code No-

a) 1A b) 2 c) 5A d) 7

---

59. Referring to Q 58. The transmission speed of the code should be-

a) 45·5 or 50 Bauds. b) 100 or 115 Bauds.

c) 600 bits/sec. d) 1200 bits/sec.

---

60. The frequency band in which your power is limited to 9dBW for CW and telephony, and 15dBW PEP for SSB operation is-

a) 1·81 - 2 MHz

b) 7 - 7·1 MHz

c) 144 - 146 MHz

d) 70·025 - 70·5 MHz

---

61. The maximum permitted Peak Envelope Power (PEP) in the 7, 14, 21 and 28 MHz bands for a J3E(SSB suppressed carrier) transmission is-

a) 10dBW b) 15dBW c) 20dBW d) 26dBW

62. In which two frequency bands is:- the class of emission limited to CW telegraphy by on/off keying (A1A), the power supplied to the antenna limited to 10dBW, the antenna gain restricted to 0dBd,and the signal to be horizontally polarized?

a) 1·8 and 3·5 MHz

b) 1·8 and 7 MHz

c) 1·8 and 14 MHz

d) 18 and 24 MHz

---

63. The maximum carrier power supplied to the antenna for a F3E (FM telephony) transmission in the band 144 - 146 MHz should not exceed-

a) 10dBW b) 16dBW c) 20dBW d) 26dBW

---

64. Referring to Q 63. A RF power meter connected at the antenna would indicate a power, when this maximum has been reached of

a) 10W b) 35W c) 100W d) 400W

---

65. The maximum permitted carrier power supplied by a CW transmitter operating in the 14MHz band is 20dBW.
What is 20dBW expressed in terms of power measured on an RF power meter connected at the antenna?

a) 10W b) 35W c) 100W d) 250W

---

66. The RF carrier power of a transmitter operating on CW in the 28MHz band is measured at the antenna input and found to be 90 watts. What is the power expressed in terms of decibels relative to 1 watt. (dBW)?

a) 9dBW b) 30·3dBW c) 19·5dBW d) 25·8dBW

67. The measured RF output power of a transmitter is 32 watts. What is the power expressed in terms of dBW?

a) 15dBW b) 16dBW c) 20dBW d) 26dBW

---

68. What is the maximum permitted Peak Envelope Power (PEP) for a J3E (single sideband suppressed carrier) transmission in the frequency band 144 - 146 MHz?

a) 9dBW b) 10dBW c) 16dBW d) 26dBW

---

69. On which frequency band shall operation cease immediately on the demand of a government official?

a) 1•8 - 2•0 MHz

b) 28 - 29•7 MHz

c) 70•025 - 70•5 MHz

d) 430 - 432 MHz

---

70. Two frequency bands are shared with other services. What are they?

a) 1•8 and 3•5 MHz

b) 1•8 and 7 MHz

c) 28 and 70 MHz

d) 28 and 432 MHz

---

71. As the licensee of an amateur radio station, the only other persons that you will allow to operate your station must-

a) hold a pass certificate in the regulation section of the City and Guilds Radio Amateurs Examination.

b) hold a current Amateur Licence or an Amateur Radio certificate, and be under your direct supervision.

c) be acting under the authority of the Secretary of State.

d) be over the age of 14 and under your direct supervision.

72. The station receiver must be capable of receiving-

a) all Standard Frequency Service transmissions.

b) all classes of emission and frequencies in use at the station.

c) all frequency bands for which the licence covers.

d) at least the third harmonic of the highest frequency of transmission.

---

73. The recommended 'phonetic' spelling for the word 'RADIO' is-

a) ROMEO ABLE DOG INDIA OCEAN

b) ROGER ABLE DAY INK OSCAR

c) RADIO APPLE DOG INK OLD

d) ROMEO ALPHA DELTA INDIA OSCAR

---

74. Amateur transmissions from any Estuary,Dock or Harbour are-

a) permitted for 5 minute periods at 15 minutes past each hour.

b) not permitted.

c) permitted with the permission of the local coastguard.

d) permitted with permission from the officer in charge of the nearest coastal radio station.

---

75. The Radio Amateur Examination is conducted by the-

a) Radio Society of Great Britain.

b) Secretary of State.

c) City and Guilds of London Institute.

d) head office of British Telecom.

76. On frequencies above 440MHz, reference is made to the Maximum d.c. input power instead of the carrier power supplied to the antenna. Where is the d.c. input power measured?

a) At the output of the power supply unit.

b) At the input of the power supply unit.

c) In the power supply to the anode of the valve or other device energising the antenna.

d) In the low pass filter of the PA stage.

---

77. You have measured the d.c. supply current and voltage to the RF output stage of a transmitter operating in the 1240 - 1260 MHz band. How will you calculate the d.c. input power?

a) Divide the current by the voltage.

b) Divide the voltage by the current.

c) Multiply the current by the voltage.

d) Multiply the power by the voltage.

---

78. The PA stage of a FM transmitter operating in the frequency band 1240 - 1260 MHz has an input current of 3 amps at 50 volts. What is the d.c. input power?

a) 3W b) 50W c) 150W d) 300W

---

79. A RF carrier power of 100 watts is supplied to a yagi antenna having a gain of 3dB relative to a half wave dipole. What is the effective radiated power (ERP)?

a) 100W b) 200W c) 300W d) 400W

20. LICENSING CONDITIONS

1	c	21	c	41	b	61	d
2	a	22	d	42	a	62	d
3	d	23	b	43	d	63	c
4	a	24	a	44	d	64	c
5	b	25	d	45	b	65	c
6	c	26	c	46	a	66	c
7	d	27	b	47	d	67	a
8	a	28	d	48	d	68	d
9	c	29	a	49	a	69	c
10	a	30	c	50	b	70	a
11	a	31	a	51	c	71	b
12	c	32	b	52	a	72	b
13	d	33	c	53	c	73	d
14	a	34	b	54	b	74	b
15	d	35	a	55	d	75	c
16	c	36	d	56	c	76	c
17	c	37	a	57	c	77	c
18	b	38	a	58	b	78	c
19	c	39	d	59	a	79	b
20	d	40	c	60	a		

21. COMPUTER PROGRAMS

The following computer programs have been written especially for this publication by

*** ANDY ESKELSON G8POY ***

to whom I offer my sincere thanks.

The programs have been written in microsoft BASIC for Commodore PET/CBM machines with BASIC 2.0. and the soundbox on the CB2 port, and also the 4000 and 8000 series machines, i.e. models 2001 to 8000.
The first three programs will also run on the CBM 64 and perhaps with some modification to the screen layout, the VIC 20.

The programs can, with some modification, be programmed for most home computers with which the programmer has aquired the necessary degree of expertise. To assist the task of programming other machines, a list of the special Commodore CBM screen editing commands is given at the end of this introduction, with their function.

The first program is a menu driven program. This will help the Radio Amateur Examination student solve most of the mathematical problems that he is likely to encounter in his studies.

The complete program is divided into a number of sections, each one of which can be programmed individually as a stand-alone program in its own right, therefore, although the full program requires over 11K of memory, an unexpanded VIC 20 or any 4K or 8K machine can be programmed to handle any one or two of the sections.

The second and third short programs are again written in BASIC. One will calculate the total value of parallel resistors, and the other the total value of series capacitors. The programs will display the current value of a combination as further values are added.

The final program in this section enables the computer to send morse for practice purposes. It offers the facility of variable speed and variable delay between characters. The speed and delay are set from the menu displayed on the screen.

No attempt has been made to calibrate the sending speed or delay, because this may vary when the program is run on different machines.
However, as a guide, on the CBM 3032 using BASIC 2.0, 38 is approximately 12 WPM. The delay between characters is set to 1 for normal morse.

This program will not run on the VIC 20 or the CBM 64 without modification for the sound.
The following lines require modification for sound
10080 Sets up I.O. for sound.
20030 Turns sound on.
20040 Turns sound off.

LIST OF SPECIAL COMMODORE
SCREEN EDITING COMMANDS USED
IN THE FOLLOWING PROGRAMS

*** CURSOR CONTROL CHARACTERS ***

CLEAR SCREEN -- ""
CURSOR HOME -- ""
CURSOR LEFT -- ""
CURSOR RIGHT -- ""
CURSOR UP -- ""
CURSOR DOWN -- ""

```
10 REM MENU
20 PRINT "":REM CLEAR SCREEN
30 PRINT"   *** MENU  ***"
40 PRINT
50 PRINT"OHMS LAW..................1"
60 PRINT"RESONANT FREQUENCY.......2"
70 PRINT"CAPACITIVE REACTANCE.....3"
80 PRINT"INDUCTIVE REACTANCE......4"
90 PRINT"FREQUENCY & WAVELENGTH...5"
100 PRINT"Q-FACTORS.................6"
110 PRINT"VOLTAGE DECIBELS.........7"
120 PRINT"POWER DECIBELS...........8"
130 PRINT"GENERAL IMPEADANCE.......9"
140 PRINT"DBW POWER...............10"
150 PRINT"TO EXIT.................11"
160 PRINT
170 PRINT"KEY IN THE OPTION 1-11"
180 GOSUB220
190 X=VAL(X$):IFX<1ORX>11THEN10
200 ON X GOTO2000,1000,4000,3000,5000,6000,7000,8000,9000,10000,210
210 END
220 INPUT"   .";X$:REM ERROR TRAP
230 IF X$="."THENPRINT"ERROR":GOTO200
240 RETURN
1000 REM RES.FREQUENCY
1010 F1$="                    1"
1020 F2$="FREQUENCY  =  ------------------ "
1030 F3$="              2*π*(SQR L*C)  "
1040 F5$="INDUCTANCE =  ------------------ "
1050 F6$="               4*π↑2*F↑2*C   "
1060 F8$="CAPACITANCE = ------------------ "
1070 F9$="               π↑2*4*F↑2*L   "
1080 PRINT"":REM CLEAR SREEN
1090 PRINT "ENTER 'X' FOR THE UNKNOWN"
1100 DA$="FREQUENCY":GOSUB1340:F$=X$
1110 DA$="INDUCTANCE":GOSUB1340:L$=X$
1120 DA$="CAPACITANCE":GOSUB1340:C$=X$
1130 IFF$="X"THEN1180
1140 IFL$="X"THEN1200
1150 IFC$="X"THEN1220
1160 PRINT"DATA ENTRY ERROR"
1170 FORZ=1TO2000:NEXT:GOTO1000
1180 L=VAL(L$):C=VAL(C$):F=1/((2*π)*(SQR((L*C))))
1190 P1$=F1$:P2$=F2$:P3$=F3$:GOTO1240
1200 F=VAL(F$):C=VAL(C$):L=1/(((π↑2)*4)*(F↑2)*C)
1210 P1$=F1$:P2$=F5$:P3$=F6$:GOTO1240
1220 F=VAL(F$):L=VAL(L$):C=1/(((π↑2)*4)*(F↑2)*L)
1230 P1$=F1$:P2$=F8$:P3$=F9$:GOTO1240
1240 PRINT"":REM CLS
1250 PRINT"FREQUENCY   = ";F;" HERTZ"
1260 PRINT"INDUCTANCE  = ";L;" HENRYS"
1270 PRINT"CAPACITANCE = ";C;" FARADS"
1280 PRINT:PRINT:PRINT P1$:PRINT P2$:PRINT P3$
1290 PRINT:PRINT"REPEAT Y/N?"
1300 GETX$:IFX$=""THEN1300
1310 IF X$="Y"THEN1000
1320 IFX$<>"N"THEN1300
1330 GOTO10
1340 PRINT "ENTER ";DA$
```

```
1350 INPUT"    .████";X$:REM ERROR TRAP
1360 IF X$="."THENPRINT"ERROR":GOTO1340
1370 RETURN
2000 REM OHMS LAW
2010 F1$="           V                 "
2020 F2$=" R =     ────            P = V * I "
2030 F3$="           I                 "
2040 F4$=" V =   I * R          P = I↑2 * R "
2050 F5$=""
2060 F6$="           V                  V↑2    "
2070 F7$=" I =     ────            P = ────   "
2080 F8$="           R                   R     "
2090 G1$=" R = V↑2 / W "
2100 G2$=""
2110 G3$="           W     "
2120 G4$=" V =     ────     "
2130 G5$="           I     "
2140 G6$="           W     "
2150 G7$=" I =     ────     "
2160 G8$="           V     "
2170 PRINT"␣":REM CLEAR SREEN
2180 PRINT "ENTER 'X' FOR THE UNKNOWN"
2190 C$="RESISTANCE":GOSUB2570:R$=X$
2200 C$="VOLTAGE":GOSUB2570:V$=X$
2210 C$="CURRENT":GOSUB2570:I$=X$
2220 C$="POWER":GOSUB2570:W$=X$
2230 IFW$<>"X"THEN2350
2240 IFR$="X"THEN2290
2250 IFV$="X"THEN2310
2260 IFI$="X"THEN2330
2270 PRINT"DATA ENTRY ERROR"
2280 FORZ=1TO2000:NEXT:GOTO2000
2290 V=VAL(V$):I=VAL(I$):R=V/I:W=V*I
2300 P1$=F1$:P2$=F2$:P3$=F3$:GOTO2450
2310 R=VAL(R$):I=VAL(I$):V=I*R:W=I↑2*R
2320 P1$=F4$:P2$=F5$:P3$=F5$:GOTO2450
2330 R=VAL(R$):V=VAL(V$):I=V/R:W=V↑2/R
2340 P1$=F6$:P2$=F7$:P3$=F8$:GOTO2450
2350 IFR$<>"X"THEN2390
2360 IFV$<>"X"THEN2410
2370 IFI$<>"X"THEN2430
2380 GOTO2270
2390 W=VAL(W$):R=VAL(R$):V=SQR(R*W):I=V/R
2400 P1$=G1$:P2$=G2$:P3$=G2$:GOTO2450
2410 W=VAL(W$):V=VAL(V$):R=V↑2/W:I=V/R
2420 P1$=G3$:P2$=G4$:P3$=G5$:GOTO2450
2430 W=VAL(W$):I=VAL(I$):R=W/I↑2:V=I*R
2440 P1$=G6$:P2$=G4$:P3$=G5$:GOTO2450
2450 PRINT"␣":REM CLS
2460 PRINT"    VOLTAGE = ";V;" VOLTS"
2470 PRINT"RESISTANCE = ";R;" OHMS"
2480 PRINT"    CURRENT = ";I;" AMPS"
2490 PRINT"      POWER = ";W;"WATTS"
2500 PRINT:PRINT:PRINT
2510 PRINT P1$:PRINT P2$:PRINT P3$
2520 PRINT:PRINT"REPEAT Y/N?"
2530 GETX$:IFX$=""THEN2530
2540 IF X$="Y"THEN2000
2550 IFX$<>"N"THEN2530
2560 GOTO10
```

```
2570 PRINT "ENTER ";C$
2580 INPUT"    .▓▓▓▓";X$:REM ERROR TRAP
2590 IF X$="."THENPRINT"ERROR":GOTO2570
2600 RETURN
3000 REM INDUCTIVE REACTANCE
3010 F1$="                Z         "
3020 F2$="  F = ———————————————— "
3030 F3$="         (2*π) * L     "
3040 F4$="  L = ———————————————— "
3050 F5$="         (2*π) * F
3060 F6$="  Z =    (2*π) * F * L"
3070 F7$=""
3080 PRINT"▓":REM CLEAR SREEN
3090 PRINT "ENTER 'X' FOR THE UNKNOWN"
3100 DA$="FREQUENCY":GOSUB3350:F$=X$
3110 DA$="INDUCTANCE":GOSUB3350:L$=X$
3120 DA$="REACTANCE":GOSUB3350:Z$=X$
3130 IFF$="X"THEN3180
3140 IFL$="X"THEN3200
3150 IFZ$="X"THEN3220
3160 PRINT"DATA ENTRY ERROR"
3170 FORZ=1TO2000:NEXT:GOTO3010
3180 L=VAL(L$):Z=VAL(Z$):F=Z/((2*π)*L)
3190 P1$=F1$:P2$=F2$:P3$=F3$:GOTO3240
3200 F=VAL(F$):Z=VAL(Z$):L=Z/((2*π)*F)
3210 P1$=F1$:P2$=F4$:P3$=F5$:GOTO3240
3220 F=VAL(F$):L=VAL(L$):Z=2*π*F*L
3230 P1$=F6$:P2$=F7$:P3$=F7$:GOTO3240
3240 PRINT"▓":REM CLS
3250 PRINT"FREQUENCY   = ";F;" HERTZ"
3260 PRINT"INDUCTANCE  = ";L;" HENRYS"
3270 PRINT"REACTANCE   = ";Z;" OHMS"
3280 PRINT:PRINT
3290 PRINT P1$:PRINT P2$:PRINT P3$
3300 PRINT:PRINT "REPEAT Y/N?"
3310 GETX$:IFX$=""THEN3310
3320 IF X$="Y"THEN3010
3330 IFX$<>"N"THEN3310
3340 GOTO10
3350 PRINT "ENTER ";DA$
3360 INPUT"    .▓▓▓▓";X$:REM ERROR TRAP
3370 IF X$="."THENPRINT"ERROR":GOTO3350
3380 RETURN
4000 REM CAPACTIVE REACTANCE
4010 F1$="                  1       "
4020 F2$="  F =     ———————————————— "
4030 F3$="          (2*π) * C * Z "
4040 F4$="  C =     ———————————————— "
4050 F5$="          (2*π) * F * Z "
4060 F6$="  Z =     ———————————————— "
4070 F7$="          (2*π) * F * C "
4080 PRINT"▓":REM CLEAR SREEN
4090 PRINT "ENTER 'X' FOR THE UNKNOWN"
4100 DA$="FREQUENCY":GOSUB4350:F$=X$
4110 DA$="CAPACITANCE":GOSUB4350:C$=X$
4120 DA$="REACTANCE":GOSUB4350:Z$=X$
4130 IFF$="X"THEN4180
4140 IFC$="X"THEN4200
4150 IFZ$="X"THEN4220
4160 PRINT"DATA ENTRY ERROR"
```

```
4170 FORZ=1TO2000:NEXT:GOTO4010
4180 C=VAL(C$):Z=VAL(Z$):F=1/(((2*π)*C)*Z)
4190 P1$=F1$:P2$=F2$:P3$=F3$:GOTO4240
4200 F=VAL(F$):Z=VAL(Z$):C=1/(((2*π)*F)*Z)
4210 P1$=F1$:P2$=F4$:P3$=F5$:GOTO4240
4220 F=VAL(F$):C=VAL(C$):Z=1/(((2*π)*F)*C)
4230 P1$=F1$:P2$=F6$:P3$=F7$:GOTO4240
4240 PRINT"▙":REM CLS
4250 PRINT"FREQUENCY   = ";F;" HERTZ"
4260 PRINT"CAPACITANCE = ";C;" FARADS"
4270 PRINT"REACTANCE   = ";Z;" OHMS"
4280 PRINT:PRINT
4290 PRINT P1$:PRINT P2$:PRINT P3$
4300 PRINT:PRINT"REPEAT Y/N?"
4310 GETX$:IFX$=""THEN4310
4320 IF X$="Y"THEN4010
4330 IFX$<>"N"THEN4310
4340 GOTO10
4350 PRINT "ENTER ";DA$
4360 INPUT"    .█████";X$:REM ERROR TRAP
4370 IF X$="."THENPRINT"ERROR":GOTO4350
4380 RETURN
5000 REM WAVELENGTH
5010 PRINT"▙":REM CLEAR SREEN
5020 PRINT "ENTER 'X' FOR THE UNKNOWN"
5030 DA$="WAVELENGTH":GOSUB5320:Y$=X$
5040 DA$="FREQUENCY":GOSUB5320:F$=X$
5050 DA$="DIPOLE LENGTH":GOSUB5320:D$=X$
5060 IFY$="X"ANDF$="X"ANDD$<>"X"THEN5170
5070 IFY$="X"ANDF$="X"ANDD$="X"THEN5110
5080 IFY$="X"THEN5130
5090 IFF$="X"THEN5140
5100 IFD$="X"THEN5150
5110 PRINT"DATA ENTRY ERROR"
5120 FORZ=1TO2000:NEXT:GOTO5000
5130 F=VAL(F$):Y=300E6/F:GOTO5160
5140 Y=VAL(Y$):F=300E6/Y:GOTO5160
5150 F=VAL(F$):Y=VAL(Y$)
5160 DD=Y/2:D1=DD/100:D=95*D1:GOTO5190
5170 D=VAL(D$):DD=D/95:D1=D+(5*DD):Y=2*D1
5180 F=300E6/Y:GOTO5190
5190 PRINT"FREQUENCY       = ";F;" HERTZ"
5200 PRINT"WAVELENGTH      = ";Y;" METRES
5210 PRINT"DIPOLE LENGTH = ";D;" METRES"
5220 PRINT"(95% OF HALF WAVE)"
5230 PRINT:PRINT
5240 PRINT"       300E6                   300E6 "
5250 PRINT"F = ----------          WL = ----------"
5260 PRINT"         WL                      F    "
5270 PRINT:PRINT"REPEAT Y/N?"
5280 GETX$:IFX$=""THEN5280
5290 IF X$="Y"THEN5000
5300 IFX$<>"N"THEN5280
5310 GOTO10
5320 PRINT "ENTER ";DA$
5330 INPUT"    .█████";X$:REM ERROR TRAP
5340 IF X$="."THENPRINT"ERROR":GOTO5320
5350 RETURN
6000 REM Q-FACTORS
6010 F1$="  X =  R * Q "
```

```
6020 F2$=""
6030 F3$="                X
6040 F4$="  Q =       _____ "
6050 F5$="               R  "
6060 F6$="  R =       _____ "
6070 F7$="               Q  "
6080 PRINT"▙":REM CLEAR SREEN
6090 PRINT "ENTER 'X' FOR THE UNKNOWN"
6100 DA$="REACTANCE ":GOSUB6340:Z$=X$
6110 DA$="Q-FACTOR" :GOSUB6340:Q$=X$
6120 DA$="SERIES RESISTANCE":GOSUB6340:R$=X$
6130 IFZ$="X"THEN6180
6140 IFQ$="X"THEN6200
6150 IFR$="X"THEN6220
6160 PRINT"DATA ENTRY ERROR"
6170 FORZ=1TO2000:NEXT:GOTO6010
6180 R=VAL(R$):Q=VAL(Q$):Z=R*Q
6190 P1$=F1$:P2$=F2$:P3$=F2$:GOTO6240
6200 Z=VAL(Z$):R=VAL(R$):Q=Z/R
6210 P1$=F3$:P2$=F4$:P3$=F5$:GOTO6240
6220 Z=VAL(Z$):Q=VAL(Q$):R=Z/Q
6230 P1$=F3$:P2$=F6$:P3$=F7$:GOTO6240
6240 PRINT"▙":REM CLS
6250 PRINT"Q-FACTOR     = ";Q
6260 PRINT"REACTANCE    = ";Z;" OHMS"
6270 PRINT"RESISTANCE   = ";R;" OHMS"
6280 PRINT:PRINT P1$:PRINT P2$:PRINT P3$
6290 PRINT:PRINT"REPEAT Y/N?"
6300 GETX$:IFX$=""THEN6300
6310 IF X$="Y"THEN6010
6320 IFX$<>"N"THEN6300
6330 GOTO10
6340 PRINT "ENTER ";DA$
6350 INPUT"    .▌▌▌▌▌";X$:REM ERROR TRAP
6360 IF X$="."THENPRINT"ERROR":GOTO6340
6370 RETURN
7000 REM VOLTAGE DECIBEL
7010 F1$= "                    (V2)  "
7020 F2$= "   DB = 20 * LOG  ------  "
7030 F3$= "                    (V1)  "
7040 F4$= "                 V2
7050 F5$= "  V1 =    ------------------
7060 F6$= "              EXP (DB/20)
7070 F7$= "  V2 =  V1 * EXP (D/20)
7080 F8$=""
7090 PRINT"▙":REM CLEAR SREEN
7100 PRINT "ENTER 'X' FOR THE UNKNOWN"
7110 CV=LOG(10):REM NAT LOG TO BASE 10
7120 DA$="DECIBELS":GOSUB7370:D$=X$
7130 DA$="VOLTAGE #1":GOSUB7370:V1$=X$
7140 DA$="VOLTAGE #2":GOSUB7370:V2$=X$
7150 IFD$="X"THEN7200
7160 IFV1$="X"THEN7220
7170 IFV2$="X"THEN7240
7180 PRINT"DATA ENTRY ERROR"
7190 FORZ=1TO2000:NEXT:GOTO7010
7200 V1=VAL(V1$):V2=VAL(V2$):D=20*((LOG(V2/V1))/CV)
7210 P1$=F1$:P2$=F2$:P3$=F3$:GOTO7260
7220 D=VAL(D$):V2=VAL(V2$):V1=V2/EXP(((D/20)*CV))
7230 P1$=F4$:P2$=F5$:P3$=F6$:GOTO7260
```

```
7240 D=VAL(D$):V1=VAL(V1$):V2=V1*(EXP(((D/20)*CV)))
7250 P1$=F7$:P2$=F8$:P3$=F8$:GOTO7260
7260 PRINT"□":REM CLS
7270 PRINT"DECIBELS     = ";D;" DB"
7280 PRINT"VOLTAGE #1   = ";V1;" VOLTS"
7290 PRINT"VOLTAGE #2   = ";V2;" VOLTS"
7300 PRINT:PRINT
7310 PRINT P1$:PRINT P2$:PRINT P3$
7320 PRINT:PRINT"REPEAT Y/N?"
7330 GETX$:IFX$=""THEN7330
7340 IF X$="Y"THEN7010
7350 IFX$<>"N"THEN7330
7360 GOTO10
7370 PRINT "ENTER ";DA$
7380 INPUT"    .▮▮▮▮▮▮";X$:REM ERROR TRAP
7390 IF X$="."THENPRINT"ERROR":GOTO7370
7400 RETURN
8000 REM POWER DECIBEL
8010 F1$= "                      (P2) "
8020 F2$= "   DB = 10 * LOG ------ "
8030 F3$= "                      (P1) "
8040 F4$= "                    P2
8050 F5$= "  P1 =    -------------------
8060 F6$= "               EXP (DB/10)
8070 F7$= "  P2 =  P1 * EXP (D/10)
8080 F8$=""
8090 PRINT"□":REM CLEAR SREEN
8100 PRINT "ENTER 'X' FOR THE UNKNOWN"
8110 CV=LOG(10):REM NAT LOG TO BASE 10
8120 DA$="DECIBELS":GOSUB8370:D$=X$
8130 DA$="POWER #1":GOSUB8370:P1$=X$
8140 DA$="POWER #2":GOSUB8370:P2$=X$
8150 IFD$="X"THEN8200
8160 IFP1$="X"THEN8220
8170 IFP2$="X"THEN8240
8180 PRINT"DATA ENTRY ERROR"
8190 FORZ=1TO1000:NEXT:GOTO8010
8200 P1=VAL(P1$):P2=VAL(P2$):D=10*((LOG(P2/P1))/CV)
8210 S1$=F1$:S2$=F2$:S3$=F3$:GOTO8260
8220 D=VAL(D$):P2=VAL(P2$):P1=P2/EXP(((D/10)*CV))
8230 S1$=F4$:S2$=F5$:S3$=F6$:GOTO8260
8240 D=VAL(D$):P1=VAL(P1$):P2=P1*(EXP(((D/10)*CV)))
8250 S1$=F7$:S2$=F8$:S3$=F8$:GOTO8260
8260 PRINT"□":REM CLS
8270 PRINT"DECIBELS     = ";D;" DB"
8280 PRINT"POWER #1   = ";P1;" WATTS"
8290 PRINT"POWER #2   = ";P2;" WATTS"
8300 PRINT:PRINT
8310 PRINT S1$:PRINT S2$:PRINT S3$
8320 PRINT:PRINT"REPEAT Y/N?"
8330 GETX$:IFX$=""THEN8330
8340 IF X$="Y"THEN8010
8350 IFX$<>"N"THEN8330
8360 GOTO10
8370 PRINT "ENTER ";DA$
8380 INPUT"    .▮▮▮▮▮▮";X$:REM ERROR TRAP
8390 IF X$="."THENPRINT"ERROR":GOTO8370
8400 RETURN
9000 REM GENERAL IMPEADANCE
9010 F1$="  R = SQR ( Z↑2 - X↑2 ) "
```

```
9020 F2$="  Z = SQR ( R↑2 + X↑2 ) "
9030 F3$="  X = SQR ( Z↑2 - R↑2 ) "
9040 F4$=""
9050 PRINT"♥":REM CLEAR SREEN
9060 PRINT "ENTER 'X' FOR THE UNKNOWN"
9070 DA$="RESISTANCE":GOSUB9330:R$=X$
9080 DA$="IMPEADANCE":GOSUB9330:Z$=X$
9090 DA$="REACTANCE":GOSUB9330:AA$=X$
9100 IFR$="X"THEN9150
9110 IFZ$="X"THEN9170
9120 IFAA$="X"THEN9190
9130 PRINT"DATA ENTRY ERROR"
9140 FORZ=1TO2000:NEXT:GOTO9010
9150 Z=VAL(Z$):AA=VAL(AA$):R=SQR(ABS((Z↑2)-(AA↑2)))
9160 P1$=F1$:P2$=F4$:P3$=F4$:GOTO9210
9170 R=VAL(R$):AA=VAL(AA$):Z=SQR(ABS((R↑2)+(AA↑2)))
9180 P1$=F2$:P2$=F4$:P3$=F4$:GOTO9210
9190 R=VAL(R$):Z=VAL(Z$):AA=SQR(ABS((Z↑2)-(R↑2)))
9200 P1$=F3$:P2$=F4$:P3$=F4$:GOTO9210
9210 PRINT"♥":REM CLS
9220 PRINT"RESISTANCE  = ";R;" OHMS"
9230 PRINT"IMPEADANCE  = ";Z;" OHMS"
9240 PRINT"REACTANCE   = ";AA;" OHMS"
9250 PRINT"PHASE ANGLE = ";ATN((AA/R))*(360/(2*π)) ;" DEGREES"
9260 PRINT:PRINT
9270 PRINT P1$:PRINT P2$:PRINT P3$
9280 PRINT:PRINT "REPEAT Y/N?"
9290 GETX$:IFX$=""THEN9290
9300 IF X$="Y"THEN9010
9310 IFX$<>"N"THEN9290
9320 GOTO10
9330 PRINT "ENTER ";DA$
9340 INPUT"    .▮▮▮▮";X$:REM ERROR TRAP
9350 IF X$="."THENPRINT"ERROR":GOTO9330
9360 RETURN
10000 REM POWER DBW
10010 F1$= "                 (P2) "
10020 F2$= "   DB = 10 * LOG ------"
10030 F3$= "                 (DBW) "
10040 F7$= "  P2 =  DBW * EXP (D/10)
10050 F8$=""
10060 PRINT"♥":REM CLEAR SREEN
10070 PRINT "ENTER 'X' FOR THE UNKNOWN"
10080 CV=LOG(10):REM NAT LOG TO BASE 10
10090 DA$="DECIBELS":GOSUB10300:D$=X$
10100 P1$="1"
10110 DA$="POWER ":GOSUB10300:P2$=X$
10120 IFD$="X"THEN10160
10130 IFP2$="X"THEN10180
10140 PRINT"DATA ENTRY ERROR"
10150 FORZ=1TO1000:NEXT:GOTO10010
10160 P1=VAL(P1$):P2=VAL(P2$):D=10*((LOG(P2/P1))/CV)
10170 S1$=F1$:S2$=F2$:S3$=F3$:GOTO10200
10180 D=VAL(D$):P1=VAL(P1$):P2=P1*(EXP(((D/10)*CV)))
10190 S1$=F7$:S2$=F8$:S3$=F8$:GOTO10200
10200 PRINT"♥":REM CLS
10210 PRINT"DECIBELS    = ";D;" DBW"
10220 PRINT"POWER       = ";P2;" WATTS"
10230 PRINT:PRINT
10240 PRINT S1$:PRINT S2$:PRINT S3$
```

```
10250 PRINT:PRINT"REPEAT Y/N?"
10260 GETX$:IFX$=""THEN10260
10270 IF X$="Y"THEN10010
10280 IFX$<>"N"THEN10260
10290 GOTO10
10300 PRINT "ENTER ";DA$
10310 INPUT"    .▌██▌";X$:REM ERROR TRAP
10320 IF X$="."THENPRINT"ERROR":GOTO10300
10330 RETURN
```

```
100 REM RESISTORS IN PARALLEL
110 PRINT"◣":REM CLEAR SCREEN
120 PRINT "THIS PROGRAM WILL GIVE"
130 PRINT "THE RESISTANCE OF ANY"
140 PRINT "NUMBER OF RESISTORS WHEN"
150 PRINT "THEY ARE CONNECTED IN "
160 PRINT "THE PARALLEL CONFIGURATION"
170 PRINT:PRINT:PRINT
180 PRINT "ENTER THE VALUES IN OHMS"
190 PRINT "AND AFTER EACH ENTRY THE"
200 PRINT "RESULT WILL BE DISPLAYED"
210 PRINT:PRINT:PRINT
220 PRINT "PRESS 'X' TO EXIT PROGRAM"
230 PRINT "PRESS THE '@' KEY TO START"
240 PRINT "A NEW CALCULATION"
250 PRINT:PRINT:PRINT
260 PRINT "PRESS SPACE TO CONTINUE"
270 GET Q$:IFQ$<>" "THEN270
1000 REM MAIN PROG
1010 PRINT"◣"
1020 PRINT"ENTER RESISTANCE"
1030 INPUT"   .▒▒▒▒";A$:REM TRAP RETURN
1040 IF A$="."THEN1000
1050 IF A$="@"THENX=0:GOTO1000
1060 IF A$="X"THEN STOP
1070 A=VAL(A$)
1080 IF A=0THENA=1:REM TRAP OUT ZERO
1090 X=X+(1/A)
1100 PRINT "TOTAL = ";(1/X);"OHMS"
1110 GOTO 1020
```

```
100 REM CAPACITORS IN SERIES
110 PRINT"♥":REM CLEAR SCREEN
120 PRINT "THIS PROGRAM WILL GIVE"
130 PRINT "THE CAPACITANCE OF ANY"
140 PRINT "NUMBER OF CAPACITORS WHEN"
150 PRINT "THEY ARE CONNECTED IN "
160 PRINT "THE SERIES CONFIGURATION"
170 PRINT:PRINT:PRINT
180 PRINT "ENTER THE VALUES IN FARADS"
190 PRINT "AND AFTER EACH ENTRY THE"
200 PRINT "RESULT WILL BE DISPLAYED"
210 PRINT:PRINT:PRINT
220 PRINT "PRESS 'X' TO EXIT PROGRAM"
230 PRINT "PRESS THE '@' KEY TO START"
240 PRINT "A NEW CALCULATION"
250 PRINT:PRINT:PRINT
260 PRINT "PRESS SPACE TO CONTINUE"
270 GET Q$:IFQ$<>" "THEN270
1000 REM MAIN PROG
1010 PRINT"♥"
1020 PRINT"ENTER CAPACITANCE"
1030 INPUT"  .▌▌▌▌";A$:REM TRAP RETURN
1040 IF A$="."THEN1000
1050 IF A$="@"THENX=0:GOTO1000
1060 IF A$="X"THEN STOP
1070 A=VAL(A$)
1080 IF A=0THENA=1:REM TRAP OUT ZERO
1090 X=X+(1/A)
1100 PRINT "TOTAL = ";(1/X);"FARADS"
1110 GOTO 1020
```

```
1 SP=75:DL=10 :REM INITIAL VALUES
10 DIM WW(12,5)
20 GOSUB 10000:REM SET UP DATA
30 PRINT"■                ■MORSE PRACTICE■■"
40 PRINT"       ■(C) A.ESKELSON G8POY 1983"
50 PRINT"■■■                  MENU"
60 PRINT"■     1.....SEND AND VIEW LETTERS
70 PRINT"■     2.....SEND THEN VIEW LETTERS"
80 PRINT"■     3.....SEND AND VIEW NUMBERS"
90 PRINT"■     4.....SEND THEN VIEW NUMBERS"
100 PRINT"■     5.....SET SPEED"
105 PRINT"■     6.....SET DELAY"
110 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■WHICH OPTION ";:INPUT"   .■■■■";OP
111 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■
120 IFOP$="."THEN110
130 OP=VAL(OP$)
140 IF OP>6THEN110
150 ON OP GOTO2000,3000,4000,5000,6000,7000
160 GOTO110
800 PRINT"■PRESS  SPACE TO CONTINUE"
810 GET TT$:IFTT$<>" "THEN810
830 GOTO30
999 END
1000 REM SEND AND VIEW
1010 REM PUT CHAR INTO X%
1020 REM CALL20000 TO SEND
1030 REM SET SPEED WITH SP
2000 REM ROUTINE TO SEND RANDOM GROUPS
2010 PRINT"■":GOSUB30000:REM  5 LETTER GROUPS
2060 REM NOW SEND THE GROUPS
2070 FOR EE=1TO12:FOR QQ=1 TO 5
2080 X%=WW(EE,QQ):GOSUB20000
2090 PRINTCHR$(X%+64);:  NEXT
2100 FOR RR=1TO500:NEXT:PRINT:REM PAUSE
2110 NEXT
2120 GOTO800
3000 REM SEND THEN VIEW
3010 PRINT"■":GOSUB30000
3020 FOR EE=1TO12:FOR QQ=1 TO 5
3030 X%=WW(EE,QQ):GOSUB20000
3040 NEXT
3050 FOR RR=1TO500:NEXT:PRINT:REM PAUSE
3060 NEXT:PRINT"■"
3070 FOR EE=1TO12:FOR QQ=1 TO 5
3080 PRINTCHR$(WW(EE,QQ)+64);:NEXT
3090 PRINT:NEXT
3100 GOTO 800
4000 REM ROUTINE TO SEND RANDOM GROUPS
4010 PRINT"■": GOSUB40000:REM  5 FIG GROUPS
4060 REM NOW SEND THE GROUPS
4070 FOR EE=1TO12:FOR QQ=1 TO 5
4080 X%=WW(EE,QQ):GOSUB20000
4090 PRINTCHR$(X%+21);:  NEXT
4100 FOR RR=1TO500:NEXT:PRINT:REM PAUSE
4110 NEXT
4120 GOTO800
5000 REM SEND THEN VIEW
5010 PRINT"■":GOSUB40000
5020 FOR EE=1TO12:FOR QQ=1 TO 5
```

```
5030 X%=WW(EE,QQ):GOSUB20000
5040 NEXT
5050 FOR RR=1TO500:NEXT:PRINT:REM PAUSE
5060 NEXT:PRINT"▙"
5070 FOR EE=1TO12:FOR QQ=1 TO 5
5080 PRINTCHR$(WW(EE,QQ)+21);:NEXT
5090 PRINT:NEXT
5100 GOTO 800
6000 REM SET SPEED
6010 PRINT"▙"
6020 PRINT"                ▣▣▣SET SPEED BETWEEN"
6030 PRINT"    ▣ 15..(FAST) AND 100..(SLOW)
6040 PRINT
6050 PRINT
6060 INPUT"SPEED    0▌█▌▌";SP
6070 IF SP=0 THENPRINT"▭▭":GOTO6040
6080 GOTO800
6999 END
7000 REM SET DELAY
7010 PRINT"▙"
7020 PRINT"                ▣▣▣SET DELAY BETWEEN"
7030 PRINT"    ▣ 1...(NO DELAY) AND 100..(LONG DELAY)
7040 PRINT
7050 PRINT
7060 INPUT"DELAY    0▌█▌▌";DL
7070 IF SP=0 THENPRINT"▭▭":GOTO7040
7080 GOTO800
7999 END
10000 DIMN$(36):FORI=1TO36:READN$(I):NEXT
10020 DATA15,5111,5151,511,1,1151,551,1111,11,1555,515,1511
10040 DATA55,51,555,1551,5515,151,111,5,115,1115,155,5115
10060 DATA5155,5511,55555,15555,11555,11155,11115,11111,51111,
      55111,55511,55551
10080 POKE59467,16:POKE59466,15:POKE59464,0:RETURN
20000 FORJ=1TOSP*5:NEXT
20020 FORI=1TOLEN(N$(X%))
20030 POKE59464,50:FORJ=1TOSP*VAL(MID$(N$(X%),I,1)):NEXT
20040 POKE59464,0:FORJ=1TOSP:NEXT:NEXT
20050 FORJ=1TOSP:NEXT
20060 FORJ=1TODL*DL:NEXT:RETURN
30000 FOREE=1TO12:FOR QQ=1 TO 5:
30010 Q=INT(RND(1)*27):REM THE LETTERS
30020 IFQ=0THEN30010
30030 WW(EE,QQ)=Q:REM 5 LETTER GROUP
30040 NEXT:NEXT:REM LETTERS 12*5
30050 RETURN
40000 FOREE=1TO12:FOR QQ=1 TO 5:
40010 Q=INT((RND(1)*10)+27):REM THE FIGS
40020 IFQ=0THEN30010
40030 WW(EE,QQ)=Q:REM 5 FIG GROUP
40040 NEXT:NEXT:REM LETTERS 12*5
40050 RETURN
```

NOTES

NOTES

NOTES

APPENDIX A

THE EXAMINATION PATTERN

OBJECTIVES AND SYLLABUS

OF THE

CITY AND GUILDS OF LONDON INSTITUTE

RADIO AMATEURS' EXAMINATION

The author is grateful to the City and Guilds of London Institute for permission to reproduce the material included in this appendix.

EXAMINATION PATTERN

The examination for 765 Radio Amateurs consists of two separate papers,765-1-01 Licensing Conditions and Transmitter Interference and 765-1-02 Operating Practices, Procedures and Theory.
765-1-01 contains 35 multiple choice questions and 765-1-02 contains 60 multiple choice questions. Questions are allocated to the syllabus sections as indicated below.

765-1-01 Licensing Conditions and Transmitter Interference (1 hour)

	SYLLABUS	QUESTIONS
1	Licensing Conditions	23
2	Transmitter Interference	12
		35

There will be a break of 15 minutes between the two papers.

765-1-02 Operating Practices, Procedures and Theory ($1\frac{3}{4}$ hours)

	SYLLABUS	QUESTIONS
1	Operating practices and Procedures	5
2	Electrical Theory	11
3	Solid State Devices	9
4	Radio Receivers	9
5	Transmitters	9
6	Propagation and Aerials	10
7	Measurement	7
		60

OBJECTIVES AND SYLLABUS

765 -RADIO AMATEURS' EXAMINATION - LICENSING CONDITIONS AND TRANSMITTER INTERFERENCE

NOTE. The examination objectives describe in general terms the nature of the examination questions, and the syllabus states the subject matter to which they relate.
This syllabus will be examined in paper 765-1-01, which will contain 35 multiple choice questions.

1 LICENSING CONDITIONS

Examination Objectives

(a) Name the types and state the purposes of Amateur Licences available.

(b) State the qualifications required of their holders.

(c) State accurately the conditions of the Amateur Licence A, and the notes appended to it, with regard to

- (i) period of validity, renewal, revocation, variation and return
- (ii) places in which the station may be established and used
- (iii) purposes for which the station may be used and persons who may use it
- (iv) frequency bands, powers and classes of emission which may be used
- (v) requirements relating to avoidance of interference, restriction of bandwidth, limitation of harmonic and spurious emissions and checking transmitter performance
- (vi) requirements for log keeping, use of call signs and recorded messages, inspection and closing down of the station
- (vii) limitations and prohibitions in conection with the use of the station.

Syllabus

1 Types of licence available and the qualifications necessary.

2 Conditions (terms, provisions and limitations) laid down by the Department of Trade and Industry in the Amateur Licence A, including the notes appended and the schedules of classes of emission and frequency bands.

2 TRANSMITTER INTERFERENCE

Examination Objectives

(a) Describe the consequences of poor frequency stability.

(b) For spurious emissions

- (i) describe in non-mathematical terms their causes.
- (ii) describe methods, appropriate to the Amateur Service, of detecting and recognizing their presence.
- (iii) describe in practical terms the measures which should be taken in both the design and construction of transmitters and the use of filters to minimise them.

(c) Describe the simple means of limiting the audio bandwidth of emissions and explain why this is necessary.

(d) State the causes of mains borne interference and describe methods of suppression.

(e) Demonstrate knowledge of the Department of Trade and Industry guidelines relating to frequency checking equipment.

Syllabus

1 Frequency stability; consequences of poor frequency stability: risks of interference, out of band radiation.

2 Spurious emissions, causes and methods of prevention; harmonics of the radiated frequency, direct radiation from frequency determining and frequency changing stages of a transmitter, parasitic oscillations, key clicks, excessive sidebands due to overmodulation. Excessive deviation of FM transmitters.

3 Restriction of audio bandwidth, typical methods used and their limitations.

4 Mains borne interference, causes and methods of suppression.

5 Department of Trade and Industry requirements for frequency checking equipment: Appendix F of 'How to Become a Radio Amateur'.

OBJECTIVES AND SYLLABUS

765 - RADIO AMATEURS' EXAMINATION, OPERATING PRACTICES, PROCEDURES AND THEORY

NOTE. The examination objectives describe in general terms the nature of the examination questions, and the syllabus states the subject matter to which they relate.
This syllabus will be examined in paper 765-1-02, which will contain 60 multiple choice questions.

1 OPERATING PRACTICES AND PROCEDURES

Examination Objectives

(a) Describe the calling procedures in telegraphy and telephony.
(b) Demonstrate knowledge of maintaining a log.
(c) For satellites and repeaters
 (i) explain why they are used in the Amateur Service
 (ii) describe the method of accessing a repeater.
(d) Explain the reasons for using Q codes and other abbreviations.
(e) Demonstrate knowledge of the phonetic alphabet and explain why it is used.
(f) For safety in operating
 (i) state the precautions recommended
 (ii) explain why capacitors should be discharged
 (iii) explain why equipment to be repaired should be disconnected from the mains supply.

Syllabus

1 Calling procedures in telegraphy and telephony: general calls to all stations and calls to specific stations.
2 Log keeping: Clause 6 of the Amateur Licence A.
3 Use of satellites and repeaters: accessing a repeater.
4 Use of Q codes and other abbreviations appropriate to the Amateur Service.
5 The phonetic alphabet: reasons for its use; recommendations in 'How to Become a Radio Amateur'.
6 Safety in the amateur station; recommendations of the Radio Society of Great Britain.

2 ELECTRICAL THEORY

Examination Objectives

(a) For basic terms and units
   (i) define the terms
   (ii) state the SI units for given measurements and define their relationship to each other

(b) For current, power and resistance
   (i) state Ohm's law and use it to solve simple problems
   (ii) calculate total current in series and parallel circuits
   (iii) calculate power in a d.c. circuit
   (iv) calculate the effective resistance of resistors in series and parallel circuits
   (v) describe the function of resistors in electronic circuits; name types for given applications; give practical values
   (vi) state the magnetic and heating effects of currents and their applications.

(c) For inductance and capacitance
   (i) define the units
   (ii) state the factors which affect the value of the capacitance of a capacitor
   (iii) state the factors which affect the value of the inductance of an inductor
   (iv) explain what is meant by the time constant of circuits containing resistance and capacitance, and resistance and inductance
   (v) calculate total capacitance in series and parallel circuits
   (vi) calculate total inductance in series circuits
   (vii) explain what is meant by inductive and capacitive reactance
   (viii) explain their effects in a.c. circuits
   (ix) solve simple problems on given a.c. series circuits.

(d) Define the terms describing the sine wave.

(e) Explain simply the terms relating to power, reactance, impedance and resonance.

(f) For transformers and tuned circuits
   (i) explain the function and describe the operation of a transformer
   (ii) identify series and parallel a.c. circuits and calculate the resonant frequency from given data

cont:

2(f) Continued

(iii) explain voltage amplification and current amplification effects

(iv) state the conditions under which oscillations may be maintained.

(g) For radio and electrical components give typical tolerances and limits on the nominal values.

syllabus

1 (a) Basic electrical terms, their meaning and use: e.m.f. current, conductor, resistance, insulator, power, series circuit, parallel circuit

(b) SI units, their use and relationship to each other: volt, coulomb, ampere, ohm, watt, hertz.

2 Current, power and resistance; Ohm's law. Total current and effective resistance in series and parallel circuits. power in a d.c. circuit. Magnetic and heating effects of currents and applications.

3 Inductance and capacitance; appropriate units; effects in a.c. circuits. Effective inductance and capacitance in circuits. Meaning of inductive and capacitive reactance. Factors affecting capacitance and inductance value. Time constant.

4 Sine wave. Definition of terms: amplitude, period and frequency; instantaneous, peak, peak to peak, and r.m.s. values.

5 Power, reactance, impedance and resonance in a.c. circuits; simple explanation of terms: phase angle, phase difference, phase lead and lag, reactance, impedance, series and parallel resonance, resonant frequency and Q(magnification) factor.

6 (a) Transformers: function and operation.

(b) Tuned circuits: series and parallel a.c. circuits. resonant frequency data and calculations; voltage amplification and current amplification effects. Maintenance of oscillations in tuned circuits. Dynamic impedance.

7 Types of components used and their applications in electronic equipment; tolerances and preferred values.

3 SOLID STATE DEVICES

Examination Objectives

(a) Explain in simple terms the principles of

- (i) operation of npn and pnp transistors
- (ii) diode rectification
- (iii) biasing and protection of transistors in amplifier circuits
- (iv) operation of simple integrated circuits.

(b) Describe the operation of given devices in radio equipment.

(c) Describe and explain the principles of operation of typical power supply circuits with smoothing and voltage stabilization systems.

Syllabus

1 Characteristics and principles of operation of npn and pnp transistors; principles of diode rectification; control of output current and voltage when transistors are used as audio frequency and radio frequency amplifiers. Simple integrated circuits.

2 Use of solid state devices in radio equipment as

- (a) oscillators (crystal and variable frequency types)
- (b) amplifiers (audio and radio frequency types)
- (c) frequency changers
- (d) frequency multipliers
- (e) demodulators

3 Typical power supply circuits; power rectification; smoothing and voltage stabilization systems.

4 RADIO RECEIVERS

Examination Objectives

(a) Explain the principles of reception of given signals.
(b) Describe the operation of simple receiver circuits.
(c) State the advantages and disadvantages of high and low intermediate frequencies.
(d) Explain adjacent channel and image frequency interference and the methods of minimising them.
(e) Explain the general principles of the demodulation of frequency modulated signals.
(f) Describe the use of a beat-frequency oscillator for the reception of A1A signals.
(g) Explain the principles of reception of single-sideband signals
(h) Describe the purpose of a carrier reinsertion oscillator.

Syllabus

1 Principles of reception of continuous wave, double-sideband single-sideband and frequency-modulated signals in terms of radio frequency amplification, frequency changing (where appropriate), demodulation or detection and automatic gain control, audio amplification. The superheterodyne principle of reception.

2 Advantages and disadvantages of high and low intermediate frequencies; adjacent channel and image frequency interference and its control.

3 Typical receivers; use of a beat frequency oscillator. Characteristics of a single-sideband signal and the purpose of a carrier reinsertion oscillator.

5 TRANSMITTERS

Examination Objectives

(a) For oscillators
   (i) describe their construction
   (ii) state the factors affecting their stability.

(b) Describe the operation of given stages in transmitters. Explain the procedure for the adjustment and tuning of transmitters.

(c) For methods of keying
   (i) describe and explain the methods
   (ii) state the advantages and disadvantages of each.

(d) For modulation and types of emission
   (i) describe and explain the principles of modulation of radio frequency emissions in given modes.
   (ii) state the relative advantages of given modes
   (iii) describe the procedure for adjusting the level of modulation.

Syllabus

1 Oscillators used in transmitters; stable variable frequency and crystal controlled oscillators; their construction and factors affecting stability.

2 Transmitter stages: operation of frequency changers, frequency multipliers, high and low power amplifiers (including linear types). Procedure for transmitter adjustment.

3 Methods of keying transmitters for telegraphy; advantages and disadvantages.

4 Methods of modulation and types of emission in current use including single-sideband and frequency modulation; emissions in the A2A, A3E, J3E, F2A and F3E modes; relative advantages Adjustment of level of modulation.

6 PROPAGATION AND AERIALS

Examination Objectives

(a) Explain given basic terms.

(b) For electromagnetic waves
  - (i) explain their production
  - (ii) state the relationship between electric and magnetic components.

(c) For the ionosphere, troposphere and upper atmosphere
  - (i) describe in simple terms the structure of the ionosphere.
  - (ii) explain in simple, non-mathematical terms, the refracting and reflecting properties of the ionosphere and the troposphere
  - (iii) explain how given factors affect the ionization of the upper atmosphere
  - (iv) state the effect of varying degrees of ionization of the upper atmosphere on the propagation of electro-magnetic waves.

(d) Describe in simple terms given forms of propagation.

(e) Explain fade outs and given forms of fading.

(f) For radio waves
  - (i) state their velocity in free space
  - (ii) state the relationship between velocity, frequency and wavelength
  - (iii) calculate frequency and wavelength from given data.

(g) For aerials and transmission lines
  - (i) describe and explain their operation and construction
  - (ii) describe balanced and unbalanced feeders and explain the principles of propagation of radio waves along transmission lines; describe the effects of standing waves
  - (iii) explain the principles of coupling and matching aerials to transmitters and receivers
  - (iv) identify from diagrams typical coupling and matching arrangements.

cont:

Propagation and aerials continued

Syllabus

1 Explanation of basic terms: ionosphere, troposphere, atmosphere, field strength, polarization, maximum usable frequency, critical frequency, skip distance.

2 Generation of electromagnetic waves; relationship between electric and magnetic components.

3 Structure of the ionosphere. Refracting and reflecting properties of the ionosphere and troposphere. Effect of sunspot cycle, winter and summer seasons and day and night on the ionization of the upper atmosphere; effect of varying degrees of ionization on the propagation of electromagnetic waves.

4 Ground wave, ionospheric and tropospheric propagation.

5 Fade out and types of fading: selective, interference, polarization, absorption and skip.

6 Velocity of radio waves in free space; relationship between velocity of propagation, frequency and wavelength: calculation of frequency and wavelength.

7 Receiving and transmitting aerials; operation and construction of typical aerials including multiband and directional types; their directional properties. Coupling and matching.

8 Transmission lines; balanced and unbalanced feeders; elementary principles of propagation of radio waves along transmission lines; velocity ratio, standing waves.

7 MEASUREMENT

Examination Objectives

(a) For the measurement of a.c., d.c. and radio frequency voltages and currents
- (i) state the types of instruments in common use
- (ii) explain how errors can be caused by the effect of the instrument on the circuit.

(b) For power input and output measurement
- (i) explain in detail how d.c. power input to the final amplifier of a transmitter is measured
- (ii) describe the incorporation of metering arrangements in an amateur transmitter
- (iii) explain the method of measurement of radio frequency power output of power amplifiers (including linear types).

(c) For given frequency measuring instruments
- (i) state the purpose for which they are used
- (ii) state the relative accuracy
- (iii) describe in detail their use at an amateur transmitting station.

(d) Describe the construction of dummy loads and explain their use.

(e) explain the purpose and method of using a standing-wave ratio meter.

(f) Describe in detail the method of setting up an oscilloscope.

Syllabus

1 Types of instruments used in radio work for the measurement of a.c., d.c. and radio frequency voltages and currents; errors in measurement.

2 Measurement of
- (a) d.c. power input to the final amplifier of a transmitter.
- (b) radio frequency power output of power amplifiers (including linear types)
- (c) current at radio frequencies.

(Reference to 'How to Become a Radio Amateur'.)

cont:

Measurement continued

3 Purposes, operation and use of absorption wavemeters, heterodyne wavemeters and frequency counters; relative accuracies.

4 Dummy loads, their construction and use in tuning transmitters

5 Use of standing-wave ratio meters.

6 Setting up and use of a cathode-ray oscilloscope to examine and measure waveform and monitor the depth of modulation.

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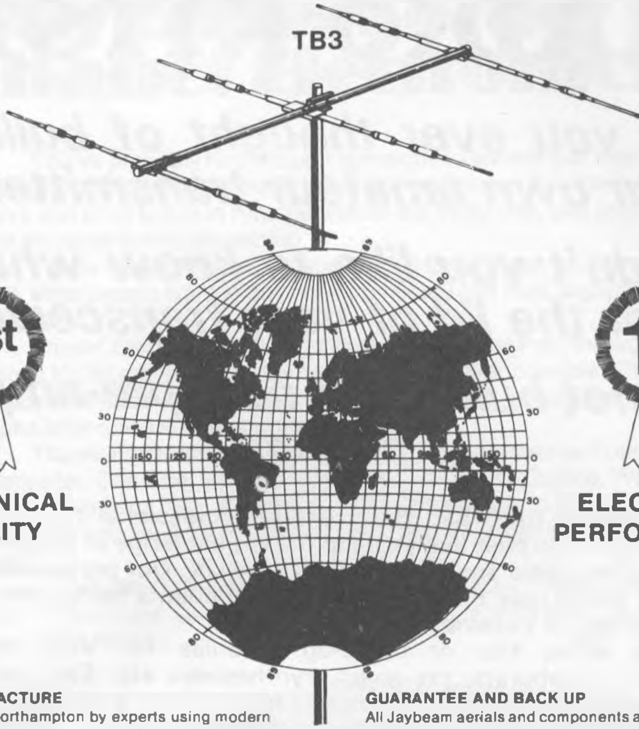

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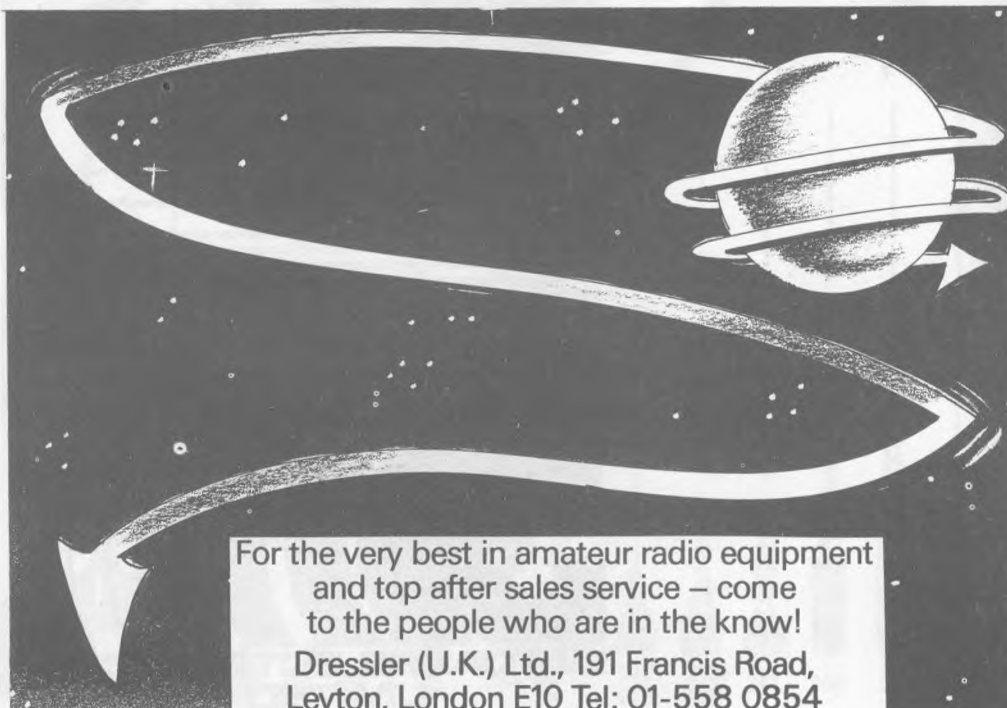
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