THE BRITISH BROADCASTING CORPORATION ENGINEERING TRAINING DEPARTMENT

T.A. EXAMINATION NO. 22

JUNE 1966

PART I | Attempt FOUR Questions | Time: 2 Hours

Full Marks Total 100

The marks allocated to each part are indicated in brackets
In descriptive questions marks are awarded
for style and presentation of subject matter

1. A basic meter movement gives a full scale reading of 1mA with 0·01V applied. Design a circuit which will convert this meter into a simple instrument to give a full scale reading for 3mA with 60mV applied.

Sketch and explain an alternative circuit arrangement that will give the required result. (10)

The instrument which you have designed is also to be used to measure resistance in conjunction with a 1·5 volt battery to give a full scale reading when the unknown resistance $R_x = 0$ and zero reading when $R_x = \infty$
What additional component is required and what values of R_x will give respectively, half scale reading; quarter scale reading and three quarter scale reading? (10)

2. The attached set of valve characteristics has a load line and static operating point P superimposed on them.

Calculate the value of the cathode bias resistor required to produce this condition. (3)

Draw a circuit diagram of the amplifier showing the component values and supply voltage. (4)

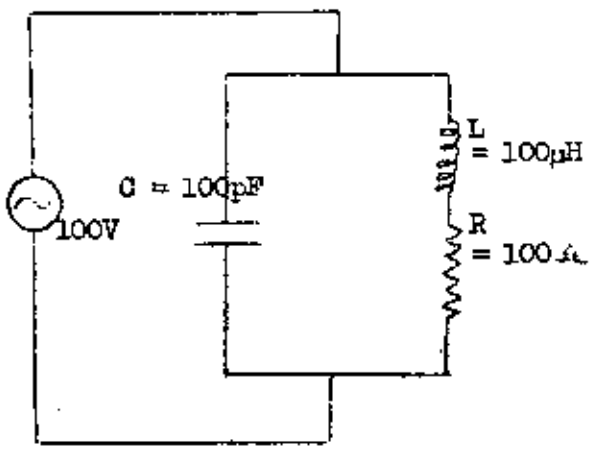
Calculate the d.c. power dissipated in the anode load resistor and the valve. (2)

Find the voltage amplification from the characteristics and the load line. (4)

Draw the Thevenin equivalent circuit for the valve and insert the values of the appropriate valve parameters obtained from the characteristics. (4)

Calculate the voltage amplification from the equivalent circuit and compare it with the value determined graphically. (3)

3.



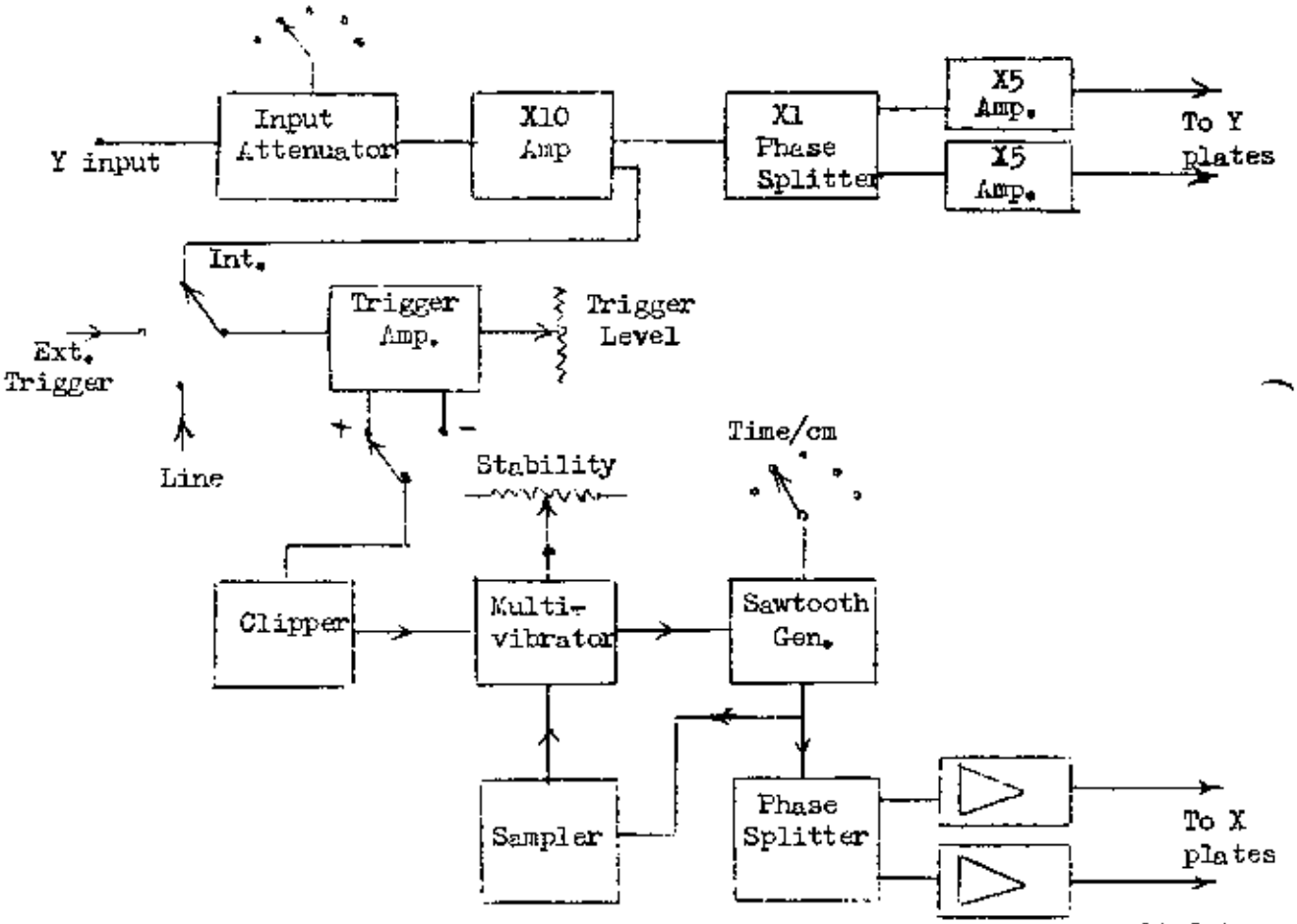
Calculate the current taken from the supply when the L, C, R circuit shown is resonant at the frequency of the supply voltage and sketch the vector diagram of currents and voltages in the circuit. (10)

Re-arrange the components of the network to give <u>two</u> different circuits which, at a particular frequency, will have an input impedance consisting of pure resistance equal to R, and calculate the frequency at which this occurs. (10)

4. The diagram shown below is of an oscilloscope which uses an electrostatically focussed c.r.t. and which has X and Y deflection sensitivities of 10 and 5 volts/cm respectively.

Draw a labelled diagram of the c.r.t. showing clearly the voltages (d.c. and a.c.) which would be found on each electrode. (8)

Explain the function of each of the stages shown in the diagram below and explain how each control must be set to produce a stable display 5 cms high, 10 cms long, of 2 cycles of a 1V peak-to-peak 10kc/s sinewave. (12)

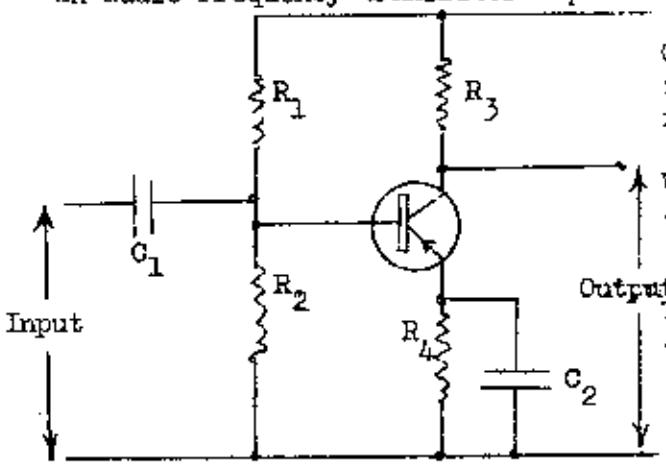


5. Three identical impedances, each consisting of a resistance of 100Ω in series with an inductive reactance of 173Ω, are connected across a 415V 3-phase supply.

The impedances are connected:- (a) in star, (b) in delta.

Calculate the line current and total power dissipated for each connection. (20)

6. Explain the purpose of each component shown in the circuit diagram of an audio frequency transistor amplifier. (6)

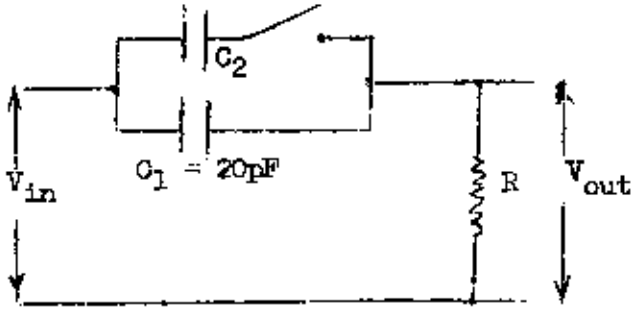


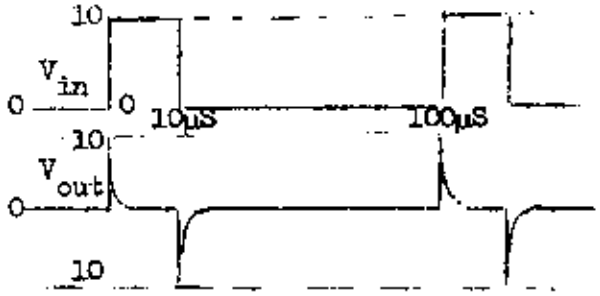
Give typical values for each capacitor, resistor and supply voltage with reasons for your choice of values. (4)

What other factors must be known to calculate the stage gain? Quote a typical value for the gain. (4)

Describe the effect on the performance of the amplifier if C_2 is omitted. (6)

7. Define time constant of a C-R circuit. (5)





A voltage with the waveform shown as V_{in} is applied to the circuit shown with the switch open. Estimate the value of resistor R so that the output waveform V_{out} is as shown.

When the switch is closed, the output waveform is required to be closely similar to V_{in}. With the value of R estimated above, suggest a reasonable value for C_2, giving the reason for the choice and sketching the output waveform which would actually occur, including values. (15)

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T.A. EXAMINATION NO. 22

PART II JUNE 1966 COMMUNICATIONS

Attempt FOUR Questions Time : 2 Hours

Each question is given a maximum of 20 marks
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for style and presentation of subject matter

1. Explain why constant resistance equalisers are used in preference to other types. (6)

Explain what precautions are taken if a half-series or half-shunt section is used to replace a constant resistance section. (4)

A half-series section is to be used in a circuit where, by using masks, it has been shown that a full section EW/3 having L_{shunt} = 0·0036H would provide adequate equalisation. What value of capacitor is required for the half-series section? (10)

2. With the aid of sketches explain the test procedure for a C9 line-feeding amplifier. Include the lining-up of the Test Equipment and indicate impedances and levels on the sketches. (14)

Give typical performance figures for each test. (6)

3. A 2-way 2-wire circuit has amplifiers at intervals such that 23dB gain is required at each repeater station. If the loss in the hybrid coils must provide stability with a 12dB safety margin, what loss is required across each coil? (6)

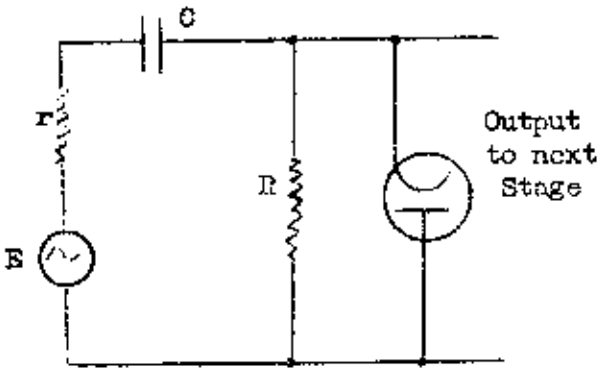
Use your results to illustrate the reasons for the common usage of 4-wire circuits for long-distance 2-way communication in preference to 2-wire repeatered circuits. (8)

A 2-way 4-wire circuit has amplifiers at intervals such that 45dB gain is required at each point. What loss is required across each coil in this case to provide the same stability margin? (6)

4. Draw a block schematic diagram of s.h.f. radio link equipment which includes a transmitter and a receiver. Briefly explain the function of each unit shown. (10)

Describe how it may be decided whether a proposed propagation path is suitable for a s.h.f. link. (10)

5. With the aid of sketches explain the effect of a.c. coupling on the black level of a television signal.



The circuit of a simple d.c. restorer which will reduce this effect, is as shown. Describe its action and discuss its limitations in maintaining a constant black level output.

What factors determine the choice of C and R?

Suggest suitable values for use on the 405-line standard giving reasons for the choice. (20)

6. Sketch the circuit of a two-stage valve amplifier capable of amplifying video frequencies, showing one form of l.f. and one form of h.f. correction. (5)

Indicate where possible the values of components and discuss the factors affecting these values. (10)

Show by sketching the four respective output waveforms the effects of l.f. under-correction, l.f. over-correction, h.f. under-correction and h.f. over-correction on a square-wave input signal. (5)

7. (a) Draw a labelled block diagram of a high-quality television monitor. With the aid of this diagram explain the ways in which the timebase generators may be synchronised. (10)

(b) Briefly discuss <u>two</u> of the following:-

(i) the r.f. amplifier of a television receiver (5)

(ii) the factors affecting the choice of the local oscillator frequency and the bandwidths of the i.f. amplifiers in a Band I television receiver. (5)

(iii) methods of obtaining field synchronising pulses from a composite television waveform. (5)