DEPARTMENT OF COMMUNICATIONS

TELEVISION STATION OPERATOR'S CERTIFICATE OF PROFICIENCY

SECTION B - TRANSMISSION, RECEPTION AND STUDIO TECHNIQUES

Unless otherwise indicated the questions in this paper pertain to the Australian Television System.

December 1984

Time Allowed to read the Paper	:	15 Minutes
Examination Time Allowed	:	Three Houres

The questions of this paper have a number of alternative answers each of which is uniquely numbered. The candidates should clearly mark on the provided "Answer Sheet" the number corresponding to the preferred answer, by encircling it.

Every question has at least one correct answer and a few questions have more than one correct answer. An additional mark will be gained by correctly identifying such plural answers.

For every question attempted:

Marking the number corresponding to a correct answer gains one mark.

Marking any other number will result in the loss of one mark.

Failure to mark a correct answer involved no penalty other than the loss of the mark awardable.

Additional time is not allowed for marking up the "Answer Sheet" and it is therefore recommended that the "Answer Sheet" be marked up progressively as questions are completed.

The "Answer Sheet" is to be handed in to the supervisor at the conclusion of the examination. The examination paper may be retained by the candidate.

The pass mark in this paper is 60%.

SECTION B - 1984

Tick correct statement and draw a circle around the appropriate number on the Answer Sheet provided.

1. The line synchronising pulses required for colour television transmission are derived from:

the mains frequency	1
the field synchronising pulses	2
the colour sub-carrier frequency	3✓

2. The duration of the post-equalising sequence is

64 microseconds	4
160 microseconds	5✓
320 microseconds	6

3. The field frequency is:

25 Hz	7
50 Hz	8✓
100 Hz	9

4. The field frequency:

is synchronous with the mains frequency	10
is derived from a free-running oscillator	11
has a fixed relationship to the colour sub-carrier frequency	12✓

5. The duration of the interval between the successive equalising pulses is equal to:

one half the line frequency	13✓
the duration of a line	14
the field duration	15

6. The duration of the line synchronising pulse interval is of the order of:

3.7 microseconds	16
4.7 microseconds	17✓
5.7 microseconds	18

7. The duration of the line blanking interval is of the order of:

6.0 microseconds	19
12.0 microseconds	20✓
18.0 microseconds	21

8. In the Australian television system a system of interlaced scanning is employed to:

simplify the design of deflection circuits 22
decrease the frequency of illumination of the screen 23
conserve bandwidth without sacrificing freedom from flicker 24

9. The colour sub-carrier burst:

is equal to 10 cycles of colour sub-carrier signal 25
has an envelope of half amplitude duration of nominally 10 microseconds 26
starts approximately 15.7 microseconds after the leading edge of the like synchronising pulse 27

10. Equalising pulses are included in the video synchronising information for the principal purpose of:

improving vertical synchronising of the receiver 28
improving the interlace of successive field scans 29
ensuring the phase reversal of the luminance information on alternate lines 30

11. In the standard odd-line interlaced television system, in order to ensure uniform spacing between successive raster lines, all even and odd fields begin:

at the same point on the raster 31
at two different points one half-line apart 32
at two different points one whole line apart 33

12. In colour television receivers, the colour synchronising information is recovered from the transmitted signal by forward biasing the burst amplifier during:

the front-porch period 34
the back-porch period 35
the line synchronising pulse interval 36

13. In the interlaced PAL television system, the four-field repetition sequences requires special blanking of burst pulses:

to enhance chrominance information suppression in the absence of colour 37
to prevent possible colour reception difficulties 38
the ensure burst phase alternation at the end of all four fields 39

14. The colour sub-carrier frequency when it is reproduced in receivers to replace the modulator-suppressed sub-carrier:

must be precisely the correct frequency and nearly the same phase 40
must be precisely the correct frequency but not necessarily the same phase 41
need not be related to the original sub-carrier 42

15. In a PAL colour television receiver, the PAL alternation identification signal is recovered from:

the burst gate signal 43
the colour-killer circuit 44
the colour sub-carrier burst 45

16. In a PAL colour television receiver, an alternating identification signal is produced to ensure that the phase of the colour sub-carrier is suitably switched, at line frequency, at the input to:

the phase discrimination circuit 46
the chrominance delay line 47
the V demodulator 48

17. The camera control unit (CCU) associated with a colour television camera chain performs a number of important functions, the most important of which is:

the operational control of the iris and focal length of the camera lens 49
the quality control monitoring of the video output signal 50
the maintenance of operational stability of the associated picture monitor 51

18. In the plumbicon camera tube, the photo-conductive signal current is:

directly proportional to the incident light intensity 52
directly proportional to the bias voltage 53
inversely proportional to the dark current 54

19. In a colour television camera registration errors would be in evidence when:

the focus modulation adjustment is not optimum 55
colour test signals are reproduced on an picture monitor with reduced saturation 56
the images scanned on the individual tubes are not precisely superimposed 57

4/...

20. When present in a television camera chain, aperture distortion causes:

excessive high-frequency gain of the camera video output stage 58
reduced black-level noise in the video output signal 59
impaired definition in reproduced images 60

21. A separate luminance tube is used in some colour television cameras to:

improve the registration of the colour signals 61
improve the depth of modulation of the luminance signal 62
ensure that a better quality compatible monochrome picture is produced 63

22. The phenomenon of "comet tail" in some colour cameras using plumbicon tubes has been overcome by providing:

a higher setting of target voltage 64
a higher beam current during retrace 65
bias lighting of the target 66

23. In order to minimise the lag problem, a light bias arrangement has been incorporated into some plumbicon camera tubes. The main purpose of the arrangement is:

to reduce the voltage on the scanned side of the photolayer target 67
to increase the resistance of the scanning beam 68
to artificially increase the dark current 69

24. The test image used for checking geometric distortion in a camera is a test chart:

consisting of a pattern of equal squares 70
with a rectangular grid of white lines 71
with a set of small diameter circles centred at the intersection of a rectangular grid 72

25. When measuring the noise content at black level in a television camera video signal output, the noise is expressed relative to a level corresponding to:

the maximum deviation of the measuring instrument 73
the resultant modulation level of the transmitter 74
a black-to-white transition in the camera output signal 75

26. The resolution of a television camera can be measured by focusing the camera on a chart containing frequency resolution gratings. The output of the camera at each frequency is compared to:

an ideal black-to-white transition on a resolution graticule
a reference level which is generated internally by the oscilloscope
an output arising from a low frequency black-to-white transition on the chart

76
77
78

27. The window signal which provides white and black areas with a sharp transition, is used in camera and transmitter testing to check for:

edge distortion, streaking and smearing
edge distortion and horizontal scanning linearity
vertical scanning linearity and resolution

79✓
80
81

28. In the plumbicon camera tube, the photoconductive target:

consists only of a layer of relatively pure photo-conductive lead oxide
incorporates a signal plate of a p-type material
is partially doped to make it a semiconductor

82
83
84✓

29. The term "orthogonal scanning" is used in television camera technology to described a method of beam deflection whereby:

only transverse magnetic field is utilised
both magnetic and electrostatic fields are utilised
the beam lands on the phototarget at right angles

85
86
87✓

30. The choice of electrical operating parameters for a plumbicon camera tube for normal operations is dictated primarily by:

the improvement in resolution as illumination of the target increases
the provision of sufficient illumination to minimise picture lag
the provision of sufficient beam current to discharge the charge pattern on the photosensitive target

88
89
90✓

Questions 31 - 42 refer to 625 line 50 field quadruplex magnetic tape recording and reproducing equipment

31. The head-to-tape velocity of television tape recording and reproducing equipment is:

dependent on the frequency of the reference source
maintained constant during all recordings and replays
adjusted for the best contrast when the picture is displayed on a monitor

91
92✓
93

32. The horizontal resolution of a videotape recording and reproducing system is its ability to define vertical lines in the image. Assuming that the scanning beam is properly focused, the horizontal resolution of the system is dependent on:

the operational video-frequency bandwidth capability of the system	94
the number of black-to-white transitions in horizontal lines	95
the amplitude of the black-to-white transitions	96

33. In television tape recording and reproducing equipment, low value of head tip penetration into the tape will:

overcome the need for velocity error compensation	97
overcome the need for dropout compensation	98
aggravate dropouts and possible head clogging	99

34. The azimuth error effect in the audio record and replay section of a television tape recording equipment would manifest itself in the output signal as:

poor high-frequency response	100
accentuated high frequency response	101
high harmonic distortion	102

35. In television tape recording and reproducing equipment, the degree of tip penetration is controlled by:

varying the tape tension	103
the position of the vacuum guide	104
the level of vacuum applied to hold the tape against the vacuum guide	105

36. In television tape reproducing equipment a defect becomes visible in the reproduced picture, when the vacuum guide is positioned too far from the headwheel axis. This defect is known as:

the azimuth error	106
the vacuum-guide effect	107
the venetian-blind effect	108

37. In a quadrature videotape recording equipment, the recorded video track is laid down at an angle to the length of the tape of approximately:

0°	109
48°	110
90°	111

7/...

38. There are two modes for quadruplex recording of video signals on magnetic tape. These modes differ basically in regard to:

the colour encoding of the video signal 112
the magnitude of the frequency deviation used 113
the angle between the video-track and the direction of tape transport 114

39. In a television tape recording system, the magnetic head gap must have a certain minimum physical size to lay down adequate field strength on the tape. The upper frequency response of such a system may be expanded by:

increasing the physical size of the gap 115
increasing the relative velocity of the tape 116
decreasing the relative velocity of the tape 117

40 When storing recorded television program tapes, precautions should be taken to ensure that the tapes are subjected to:

varying magnetic fields 118
periodic high changes in temperature 119
the relative humidity in the range of 40 to 60 percent 120

41. In a television tape recording system, the adjustment of the vacuum guide to the position which will assure interchangeability between tapes made on correctly adjusted equipment is performed by means of:

a video frequency response tape 121
an alignment tape 122
an audio distortion tape 123

42. When editing colour program on video tape, it is important that:

any odd-even field sequence be maintained through the edit point 124
the repetition sequence of the PAL signal need not be maintained through the edit point 125
the Bruch blanking sequence be maintained through the edit point 126

43. Electronic masking is incorporated in a colour telecine chain to:

enhance the contrast ratio of the luminance signal 127
automatically control the video signal levels corresponding to black and while of the scene 128
modify the R, G, B channel outputs to compensate for variations in the dyes of different film stocks 129

44. A colour telecine chain can be adjusted to have correctly matched gammas in the red, green and blue channels by:

using a test slide with two sets of colour bars and displayed on a waveform monitor 130
using a test slide with two achromatic grey scales and displayed on a waveform monitor 131
using a photometer to measure the steps of the reproduced grey scale on a picture monitor 132

45. Audio information on film release print is recorded by:

variable magnetic stripe system 133
using the variable gate principle 134
variable area or density optical system 135

46. In a film projector, uniform film velocity relative to the sound head is usually achieved by:

providing a free film loop and a film speed control device 136
using a synchronous motor to drive the project mechanism 137
providing a flywheel arrangement to control the claw and gate mechanism 138

47. In the Australian television service, films are projected at:

24 frames per second 139
25 frames per second 140
50 frames per second 141

48. In a 16mm telecine projector a shutter blade is provided to blank off the projector beam whilst the film is being moved. The shutter is also used to:

protect stationary film from overheating 142
reduce flicker 143
maintain the efficiency of illumination in the film gate 144

49. In a telecine chain the term "geometric distortion" refers to:

non-uniform grey scale reproduction 145
inaccurate reproduction of the position of scene details 146
non-uniform illumination over the scanned area 147

50. For a given light output of the scanning tube, the noise level in the signal output of a flying spot scanner is determined principally by:

the signal amplification required in the output stage of the associated photomultiplier	148
the sensitivity of the photomultiplier	149
the signal amplification of the succeeding studio equipment	150

51. To ensure efficient operation of a flying spot scanner in a television telecine chain, the scanner's cathode ray tube, which is used as a source of the flying spot of light, should be of a:

low-persistance type	151
high-persistance type	152
very slow flyback type	153

52. In the design of a sound recording studio, it is sometimes required to reduce its reverberation time. This reduction may be achieved by:

suitably modifying the frequency response of the studio output amplifiers	154
careful insulation of the studio from externally generated noise	155
lining the studio with suitable sound absorbing materials	156

53. In the design of a television studio complex, the basic preoccupation is with:

the need to locate the facilities near a town centre	157
keeping the noise out	158
the preference for the steel-framed style of building construction	159

54. The rate of decay of reverberation for each studio is known as its reverberation time. This is the time it takes for a sound to die away to:

a hundredth part of its original intensity (ie through 20dB)	160
a thousandth part of its original intensity (ie through 30dB)	161
a millionth part of its original intensity (ie through 60dB)	162

55. In a television studio, the primary purpose of the master control room is to:

produce and incorporate into complete programs all promotional and advertising information 163
edit recorded quadruplex magnetic tape material and to assemble it into a complete program 164
integrate the outputs of studios, telecine, videotape and OB to form the program for transmission 165✓

56. If a robust omnidirectional microphone, with frequency response extending up to 10 kHz, were required for outdoor use, a good choice would be:

a condenser microphone 166
a moving coil microphone 167✓
a crystal microphone 168

57. In television studio technology the term "microphone balance" refers to:

the location of microphones in relation to the sound sources and the studio acoustics 169✓
the sound mixing capabilities of the master control equipment 170
the total absence of reinforcement from the studio acoustics 171

58. In the design of a studio, acoustic transmission through glass windows can be most conveniently reduced by:

use of a specially treated single sheet of thick glass 172
careful sealing between a single glass pane and the supporting window frame 173
use of two or three non-parallel sheets of plate glass 174✓

59. Automatic gain control amplifiers are used extensively by television stations and are intended primarily to:

provide proper program mixing facilities when there are more than three program line output levels 175
produce a predetermined maximum transmitter input level over a wide range of program line output levels 176
produce a relatively constant average studio output level over a wide range of amplifier input levels 177✓

60. A stabilizing amplifier can perform a number of functions in a television station and may be used at any point in a video system where it is desired to amplify the picture signal level by a factor of ten times or more. It is also capable of performing the following operation:

improvement of the dynamic range of the accompanying audio signal 178
recombination of the processed synchronising and video signals 179
separation of the chrominance and the luminance components of the video signal being processed 180

61. If it is desired to avoid the microphone being seen in an interview scene televised outdoors and to attenuate any sound approaching the microphone from oblique angles, the following equipment is used:

a condenser microphone 181
a gun microphone 182
a ribbon microphone 183

62. The characteristic impedance of a theoretically infinite television transmission line may be defined as:

voltage-to-current ratio which is constant over the entire line 184
the ratio between its input and output impedances 185
the phase difference between its voltage and current at any point along the line 186

63. A volume unit meter is used in a television studio to monitor:

the frequency balance of sound program signals 187
the absolute level of sound program signals 188
the level of sound program signals 189

64. In describing audio test signals, the term "dBm" is used to define:

the reference power across the output impedance of an amplifier 190
a relationship between the test signal inputs to, and the respective outputs of, an amplifier 191
an absolute power reading 192

65. A volume unit meter used in a television program-orignating studio is:

a peak indicating instrument with fast attack and slow decay time 193
an average power meter 194
a relative dB meter rising to 99% of its final reading in approximately 300 milliseconds 195

66. The power in a radio frequency circuit is increased from 1 watt to 10 watts, ie by 10 dB, and the current flowing in its output impedance, the magnitude of which is identical to that of its input impedance, increases in relation to the input impedance current in the ratio of about:

1.36:1 196
3.16:1 197
5.76:1 198

67. The time domain response of video equipment is commonly specified in terms of K-rating, which uses a test waveform comprising:

a square wave test signal having a rise time of 200 nS 199
very short duration high amplitude pulses 200
a square wave and pulse of limited frequency spectrum and controlled shapes 201

68. In current lighting technique terminology, base light refers to:

front illumination of a subject in equal amounts from two directions of substantially equal and opposite angles to the camera optical axis 202
illumination directed toward the lower section or base of the scene 203
diffused illumination, approaching a shadowless condition, to provide the majority of the scene illumination 204

69. In the transmission of video signals through a long coaxial cable system, steps are taken to ensure that the most efficient transfer of signal energy is maintained, with the lowest possible signal distortion. This is achieved when:

all signal reflections within the system have been eliminated 205
sufficient signal reflections occur within the system 206
the video frequency response of the system is falling with frequency 207

70. Sections of a transmission line may be used to suppress any unwanted even harmonics in the power output circuitry of a television transmitter. Sections of the line used for this purpose are approximately:

one quarter-wavelength 208
one half-wavelength 209
one wavelength 210

71. The input impedance of an unterminated television transmission line of length greater than a quarter-wave but less than a half-wave is:

inductive	211 ✓
capacitive	212
resistive	213

72. In television aerial technology, impedance matching is often necessary between the radiating element and the transmission-line feeder. The impedance matching arrangement usually employs:

parallel-coupled inductor coils	214
an appropriately designed resistor network	215
the quarter-wave transformer	216 ✓

73. Mobile television vans for outside broadcast operation are equipped with facilities to:

receive and process the necessary synchronising pulses from the parent studio for the operation of their associated facilities	217
relay the camera output signals unsynchronised to the parent studio for subsequent incorporation into the composite video signal for broadcasting	218
generate the necessary pulse signals to synchronise the operation of their associated cameras	219 ✓

74. In a television station a diplexer is used:

to combine the outputs of two transmitters with minimum interaction	220 ✓
to combine the inputs of two transmitters with minimum interaction	221
to enable two parallel-operated vision transmitters to use a common frequency exciter	222

75. Frequency stability of an oscillator used in microwave link equipment is normally achieved by:

maintaining stable power supply voltages to the oscillators output stage	223
comparing the oscillator's output frequency with that of an inbuilt reference oscillator	224 ✓
eliminating all feed-back connections within the oscillator circuitry	225

14/...

76. The resonant circuits of a klystron power output stage are integral with the tube and are:

physically adjustable to permit tuning to the desired channel frequency and the required bandwidth 226
tunable to the desired channel frequency and the required bandwidth by application of control voltages to the cathode 227
permanently set during manufacture for operation on a specific channel frequency and bandwidth at frequencies below 300 MHz 228

77. The effective power of a vision transmitter should not differ from the authorised power by more than:

± 5% 229
±10% 230
±50% 231

78. The allowable audio frequency response of an Australian television transmitter subsystem, with reference to its output at 400 Hz, is:

±0.5 dB 232
±2.0 dB 233✓
±4.5 dB 234

79. The operational reliability of a proposed studio-transmitter microwave system can be predicted and the results may be best confirmed by:

a single transmission measurement on the path 235
several measurements at hourly intervals 236
regular measurements over a period of time 237✓

80. In the Australian television transmission system using high power modulation, the required vision carrier sideband shaping is effected by the filterplexer, which has the form of a filter, incorporating:

specially selected resistors and condensers to maintain its frequency stability 238
a series of conventional transformers, stagger-tuned over the band 239
capacitive and inductive reactances and resonant lines capable of handling high voltages 240✓

81. In the Australian television service the ratio of the peak envelope power of the vision transmitter to the mean power of the mono sound transmitter has a nominal (decibel) value of:

3 dB 241
6 dB 242
10 dB 243✓

82. In the television service, the frequency modulated sound transmission incorporates a 50 microsecond pre-emphasis network, which is used to:

ensure adequate limiting in the receiver at higher frequencies 244
enable suppression of higher frequency noise components at the receiver 245 ✓
reduce audio frequency distortion 246

83. One of the features of a vision transmitter employing low-level modulation is:

the relatively small amount of power required for its modulation purposes 247 ✓
its structurally small directional transmitting aerial 248
the relatively large amount of power required for its modulation purposes 249

84. In a television transmitter, phase modulation of visiion carrier is expressed as X dB below ± 50 kHz deviation of the sound carrier; X should be equal to, or greater than:

36 250
46 251 ✓
56 252

85. In Australian television practice, the link subdivision comprises all the equipment in the signal path:

between the studio amplifier output and the sound control equipment input at the transmitter 253 ✓
between the studio amplifier output and the vestigial sideband filter input 254
including the studio and transmitter sound and vision input equipment 255

86. Direct-current regulators are used in television transmitter equipment to control the stability of the applied voltages. Most commonly used regulators utilise:

a series or shunt-connected active current-conducting element 256 ✓
tandem-connected resistor configurations 257
a multi-tapped transformer circuit 258

87. The duration of the delay produced by an ultrasonic delay line in a domestic television receiver is basically determined by:

the line and its associated synchronous demodulator 259
the physical dimensions of the line 260 ✓
the amplitude of the chrominance signal applied to the input terminal of the line 261

16/...

88. The effect of the input capacitance of ceramic transducers, which are used with delay lines in colour television receivers, may be reduced by:

varying the length of the delay line material
the mechanical damping of the transducer base
the addition of small inductors across the terminations

262
263
264✓

89. The ultrasonic delay lines used in domestic television receivers are made from:

quartz
magneto-restrictive alloys
isopaustic glass

265
266
267✓

90. In colour television systems, balanced modulators are utilised to produce the chrominance component of the composite video signal. The chrominance signal so formed comprises:

an amplitude and phase modulated sub-carrier
two colour-difference signals
a signal with sidebands only and no sub-carrier

268
269
270✓

91. An automatic vision gain control circuit is provided in colour television receivers to ensure:

a relatively constant output from the sub-carrier oscillator
a proper relationship between the colour elements of the displayed picture
a relatively constant contrast in the displayed picture

271
272
273✓

92. The test of correct convergence of a colour television receiver is the ability of the picture tube to reproduce:

adjacent blue and red picture areas without overlap
green areas in the absence of blues and reds
black-and-white areas without colour fringing

274
275
276✓

93. An automatic chrominance gain control circuit is provided in colour television receivers to maintain the original relative amplitudes of the chrominance and luminance signals to ensure that the transmitted picture is correctly reproduced. The voltage to control the circuit is derived by:

rectifying the peaks of the chrominance signal
sensing the amplitude of the burst or of its derivative
adding the colour-difference signals

277
278✓
279

94. In colour television receivers, the colour-difference information is recovered from the transmitted signal by means of synchronous demodulators. The demodulators are called synchronous because:

they require an identical phase reference input signal from the local sub-carrier oscillator	280
they are tuned to operate with a differently modulated chrominance input signal	281
their respective detected outputs depend on the frequency and phase of the reinserted sub-carrier	282 ✓

95. Luminance signal non-linear distortion (linearity) is a measure of:

the magnitude of the overshoot of the video signal arising from abrupt changes in the average picture level	283
the magnitude of variation in small signal luminance gain as a function of the instantaneous luminance signal level	284 ✓
the magnitude of variation in the level of the top of a white bar signal due to effects having a time constant greater than 0.5 microsecond	285

96. In a shadow mask picture tube, colour purity adjustments are necessary to ensure:

that the picture does not suffer from colour fringing at luminance transitions	286
that each beam in the picture tube illuminates the phosphor dots of only one colour	287 ✓
satisfactory grey scale tracking	288

97. When measuring the signal-to-noise ratio of an audio amplifier, the noise level is normally referred to:

the full power output level of the amplifier	289 ✓
the minimum audio distortion attainable	290
the 0 dBm level of the input signal	291

98. In a colour television receiver, the colour-killer circuit usually functions as an electronic switch, which is operated when:

the colour burst is absent from the video signal	292 ✓
the colour burst is present in the video signal	293
the luminance signal is interrupted	294

99. Differential gain measurements on a colour television transmitter involve:

a substantially linear unmodulated sawtooth waveform	295
a subcarrier modulated stairstep signal	296 ✓
the video frequency response measurements about the vision carrier	297

100. The lowest frequency which can be propagated through a rectangular waveguide depends on:

the internal width of its wider wall	298 ✓
the internal width of its shorter wall	299
the external surface material of the waveguide walls	300