

**AMATEUR RADIO EXAMINATION**  
**SYLLABUS**

**(GENERAL CLASS)**

**( WITH EFFECT FROM 1990 )**

**PUBLISHED BY**

**TELECOMMUNICATIONS REGULATORY COMMISSION OF  
SRI LANKA**

**PRICE :-RS.25/=**



**AMATEUR RADIO OPERATOR'S GENERAL CLASS**  
**CERTIFICATE OF PROFICIENCY**

This examination consists of two parts.

**PART 1**      Two separate Written Papers

The questions will be based on the syllabuses attached.

- (i) Fundamentals of Electricity & Radio Communications (3 hours)
- (ii) Licencing conditions, operating practices and procedures (2 hours)



(i) **FUNDAMENTALS OF ELECTRICITY & RADIO  
COMMUNICATIONS**

(WRITTEN PAPER - SYLLABUS)

**1. ELECTRICAL LAWS & CIRCUITS**

- 1.1 Electric and Magnetic Fields :
- (a) Permanent Magnets
  - (b) Electromagnets
  - (c) Solenoids, Relays
- 1.2 Electricity and the Electric Current
- (a) Basic appreciation of electron flow and influencing factors ;
  - (b) Electromotive Force (EMF)
- 1.3 Conductors and Insulators - comparison of properties.
- 1.4 Direct Current (DC)
- (a) Power and Energy - Watts, Volts, Amperes and Ohms;
    - (i) sources of energy - primary and secondary cells basic theory, methods of connection and rate of charging, internal resistance;
    - (ii) potential difference.
    - (iii) Ohms law and power formulae.
  - (b) Resistance (including units)
    - (i) resistance in series.
    - (ii) resistance in parallel
    - (iii) colour coding and types of resistors, preferred values.
- 1.5 Alternating current (AC):
- (a) Nature and generation of the sine wave ;
    - (i) relationship-peak, average and RMS voltage values.
    - (ii) Basic knowledge of harmonics, frequency versus wavelength and their relationship.
  - (b) Capacitance (including units)
    - (i) factors affecting capacitance.
    - (ii) dielectric loss.
    - (iii) capacitive reactance.
    - (iv) capacitor types - practical aspects, methods of connection and value calculations.



- (c) Inductance (including units)
  - (i) factors affecting inductance.
  - (ii) Inductive reactance.
  - (iii) Inductance types - applications, practical limitations.
- (d) Impedance - a basic understanding, awareness of distinction between impedance and resistance.
- (e) Transformer Theory ;
  - (i) types of transformers - practical applications.
  - (ii) turns ratio, voltage ratio, impedance transformation, factors affecting efficiency, losses, electrostatic shielding.
- (f) Radio Frequency Circuits ;
  - (i) resonance in series circuits.
  - (ii) Resonance in parallel circuits.
  - (iii) Effect of "Q" (quality factor) in tuned circuits - basic understanding.
- (g) The piezoelectric Effect - basic knowledge of characteristics and applications of quartz crystal.

## 2. **CIRCUIT SYMBOLS**

Candidates should be familiar with the symbols employed in circuit drawings using one or more of the following;

- (a) resistors
- (b) capacitors
- (c) inductors
- (d) diodes (including zener, varicap)
- (e) thermionic vacuum tubes (triodes, pentodes)
- (f) transistors (bipolar and FET)
- (g) antennas
- (h) earth
- (i) loudspeaker and headphones
- (j) microphone
- (k) batteries
- (l) integrated circuits (amplifier and voltage regulators only)
- (m) inductors and transformers
- (n) meters.





### 3. LOGARITHMIC UNITS & SCALES FOR LOSS/GAIN/LEVEL

- (i) Loss, gain, dB
  - Over all loss
  - Reference equivalent
  - Conversion between dB and Neper.
- (ii) Power level, dBm
  - dBW, dBk, dBRAP
- (iii) Voltage level dBu, measurement of power level
- (iv) Relative level dBr
- (v) dBmO, dBmOp

### 4. SEMICONDUCTORS

#### 4.1 Semiconductor diodes

- (a) Characteristics and construction
  - (i) comparison of germanium and silicon
  - (ii) forward conduction
  - (iii) ratings of diodes in current and peak inverse voltage (PIV)

#### 4.2 Voltage variable capacitor diodes (varicap/varactor)

- (a) basic theory
- (b) uses

#### 4.3 Zener diodes

- (a) basic theory
- (b) uses

#### 4.4 Transistors

- (a) Types :
  - (i) NPN and PNP, bipolar
  - (ii) field effect transistors (FET)
  - (iii) Characteristics
  - (iv) advantages and disadvantages, practical applications
- (b) Amplification
  - (i) current gain - use of term beta
  - (ii) basic knowledge of types of circuits - common emitter / common source.



- 4.5 Integrated circuits - amplifiers and voltage regulators only - recognition and basic application.
- 4.6 Solid state devices (general) - practical limitations in use (e. g. voltage / power ratings and protective arrangements)

## 5. VACUUM TUBES

- 5.1 Basic principles and applications
- 5.2 The triode vacuum tube - uses
- 5.3 The pentode vacuum tube - uses

## 6. POWER SUPPLIES

- 6.1 AC power mains considerations (240V, 50 Hertz)
  - (a) safety precautions, fuses and other protective devices - ratings.
  - (b) Awareness of wiring standards and colour coding of mains flexible conductors/power points - importance of earthing.
- 6.2 Ratings of power transformers in relation to power limitations of the novice licence.
- 6.3 Rectifier circuits ;
  - (a) Types (solid state only)
    - (i) full wave
    - (ii) half wave
    - (iii) bridge circuits
  - (b) current ratings
  - (c) peak inverse voltage ratings (PIV)
- 6.4 Filtering, requirement for filtering - awareness of typical filters commonly used.



- 6.5 Voltage regulation principles.
  - (a) zener diode regulation
  - (b) solid state regulator devices - typical applications.

## 7. OSCILLATOR AND AMPLIFIER PRINCIPLES

- 7.1 Crystal oscillators and variable frequency oscillators (VFO):
  - (a) appreciation of comparative properties
  - (b) awareness of other types likely to be used in modern Amateur equipment (e.g. PLL) - a recognition of application only.
  - (c) Stability - basic understanding
- 7.2 Frequency conversion - doublers and triplers, heterodyning.
- 7.3 Amplification
  - (a) classes of amplifiers
    - (i) Class A operation
    - (ii) Class B operation
    - (iii) Class C operation
  - (b) the importance of bias
- 7.4 Radio frequency amplification
  - (a) amplifier stability and efficiency
    - (i) neutralisation
    - (ii) parasitic suppression
    - (iii) harmonic suppression



## 8. TRANSMITTERS

### 8.1 Transmitter principles

### 8.2 Morse code transmission

- (a) basic keying methods  
keying of appropriate stages in a transmitter
- (b) key clicks - cause and cures
- (c) monitoring of keying; interpretation of simple wave shapes on a cathode ray oscilloscope.

### 8.3 Amplitude modulation (AM) and single side band (SSB) transmission;

- (a) side bands and bandwidth - basic theory
- (b) the modulation envelope - recognition of modulation percentage
- (c) power in a modulated wave (related to 100% modulation)
- (d) over modulation - understanding of effects (i. e. interference)
- (e) methods of amplitude modulation
  - (i) high level modulation
  - (ii) low level modulation
- (f) microphones - dynamic (moving coil), ceramic/crystal, capacitor, electret.

### 8.4 Principles of single side band (SSB) generation - Filter method.

- (a) Basic function of ;
  - (i) balanced modulator
  - (ii) filters
  - (iii) carrier oscillator
  - (iv) mixing
  - (v) amplifiers - need for linearity

### 8.5 Practical methods of tuning power amplifier (PA) stages





## 8.6 Frequency Modulation (FM)

- (a) Basic concept;
- (b) Pre-emphasis
- (c) Types of modulators
- (d) Appreciation of the advantages of FM compared to AM & SSB

**NOTE :** An ability to be able to identify the function of each section in block diagrams of transmitters is required.

## 9. RECEIVERS

### 9.1 Receiver characteristics :

- (a) definition of selectivity ;
- (b) definition of sensitivity.

### 9.2 Detectors (elementary knowledge only)

- (a) detection for AM reception
- (b) detection for Morse code (CW) reception
- (c) detection for SSB reception
- (d) detection for FM reception

### 9.3 The super heterodyne receiver :

- (a) RF amplifiers
- (b) Mixers
- (c) IF amplifiers.
- (d) Automatic gain control (AGC)
- (e) Oscillators
- (f) Audio amplifiers
- (g) Single conversion, double conversion - relative merits ;
- (h) Limiters for FM
- (i) Capture effect (FM)
- (j) De-emphasis



- 9.4 Direct conversion receivers
  - (a) principle of operation
  - (b) unique properties, reasons for use
  
- 9.5 Transceivers
  - (a) basic concept of transceivers (combined functions using common circuitry for transmit and receive);
  - (b) appreciation of control functions on modern transceivers.

NOTE : An ability to be able to identify the function of each section in block diagrams of receivers/ transceivers is required.

## 10. PROPAGATION

- 10.1 Radio waves - basic concept :
  - (a) characteristics
    - (i) vertical polarisation
    - (ii) horizontal polarisation
  - (b) properties of the ionosphere
  
- 10.2 Means of propagation
  - (a) Ionospheric (sky wave) :
    - (i) skip distance
    - (ii) maximum usable frequency (MUF)
    - (iii) variation due to time of day frequency and seasonal changes
  - (b) ground wave, variation due to time of day and frequency.
  
- 10.3 Fading- types of fading
  
- 10.4 Reliability of high frequency propagation for long distance communications, effect of sunspot cycle.



## 11. ANTENNAS & TRANSMISSION LINES

### 11.1 Basic principles of transmission lines :

- (a) line impedance
- (b) line characteristics - practical understanding of properties :
  - (i) coaxial line
  - (ii) balanced line
- (c) need for matching of transmitter to line and line to antenna.  
basic understanding of typical matching devices (e. g. balun, antenna tuning unit (ATU) ;
- (d) practical considerations, transmit - receive switching or antenna changeover methods.

### 11.2 High frequency antennas (for use on novice bands)

- (a) antenna considerations
  - (i) vertical antenna
  - (ii) horizontal antennas
  - (iii) standing wave ratio (SWR) - desirability of low SWR.
- (b) the half-wave antenna;
  - (i) voltage and current distribution
  - (ii) impedance-effect of ground proximity
  - (iii) method of feeding a half-wave antenna
- (c) the quarter-wave vertical antenna;
  - (i) voltage and current distribution
  - (ii) impedance-effect of ground proximity
  - (iii) method of feeding a quarter-wave antenna
  - (iv) angle of radiation
- (d) artificial antenna (dummy load) use of artificial antenna for transmitter testing;
- (e) basic knowledge of parasitic arrays;
  - (i) The 3 element beam antenna - purpose of director, reflector, driven element.
  - (ii) Advantages over non-directional antennas - directional gain, interference reduction, efficiency of communication.



## 12. TEST EQUIPMENT & MEASUREMENT

### 12.1 DC moving coil meter

- (a) extending the DC current range ;
- (b) DC voltmeter
- (c) Ohm meter

### 12.2 AC instruments:

- (a) voltage measurements;
- (b) current measurements

### 12.3 Frequency measurements :

- (a) digital frequency meter (DFM) - practical uses and limitations.
- (b) The dip meter.

### 12.4 RF measurements :

- (a) transmitter power output measurements - methods; non radiating load-artificial antenna.
- (b) Transmission line measurements
  - (i) standing wave ratio (SWR)
  - (ii) forward power
  - (iii) reflected power.

### 12.5 Cathode ray oscilloscope (CRO) - an ability to interpret basic wave shapes, and practical limitations of use - measurement of modulation levels.





## 13. INTERFERENCE

### 13.1 Basic effects of interference and recognition of symptoms

### 13.2 Types of interference

- (a) television interference (TVI)
  - (i) receiver overload
  - (ii) effect on reception due to radiation of harmonics; parasitic oscillations; excessive side bands or "splatter" resulting from non-linear operation.
- (b) broadcast interference (BCI)
  - (i) receiver overload
  - (ii) cross modulation
- (c) interference to other domestic equipment.

### 13.3 Remedial measures :

- (a) use of filters;
  - (i) transmitter low pass or band pass filters - to reduce harmonics
  - (ii) receiver band pass or high pass filters - to prevent overload.
  - (iii) mains line filters - to prevent conducted RF interference.
- (c) other preventative measures (e.g. bypassing, shielding, adequate earthing).

## 14. SAFETY

### 14.1 The human body :

- (a) variations in body resistance
- (b) consequences of electric shock

### 14.2 Safety with high voltage :

- (a) safety standards ;
  - (i) bare wires
  - (ii) loss of earth connection (including RF earth)
  - (iii) charged capacitors



### 14.3 Mains wiring

- (a) Mains power point configuration
- (b) Colour code for active, neutral and earth
- (c) Difference between active, neutral and earth
- (d) Basic principles of earth connection
- (e) Fuses and circuit breakers
  - (i) principles of operation
  - (ii) importance of using appropriate rating

### 14.4 Lightning :

- (a) danger of lightning strikes
- (b) paths of entry
- (c) lightning arrestors and other precautions

14.5 Safety in use of hazardous materials or equipment (e.g. high voltage power supplies; batteries-electrolyte, ventilation charge/ discharge rate. Beryllium encapsulated solid state devices)

14.6 Safety in mobile station operation - awareness of hazards (e. g. blasting areas, power lines and explosive atmosphere)



(ii) **LICENCING CONDITIONS, OPERATING PRACTICES  
AND PROCEDURES**

**(WRITTEN PAPER - SYLLABUS)**

1. Definitions of Amateur Station, Amateur Service and General terms in usage with Amateur Radio Service.
2. Qualification for Amateur Station Licensees, General conditions to be observed by Amateur Station Licensee.
3. Technical Provisions:
  - Manner of Erection and operation of apparatus
  - Safety precautions
  - Transmitting equipment
  - Authorised Radio Frequency Bands
  - Types of Emissions
  - Stability of Emissions
  - Automatic Radio Telegraph System
  - Data & Facsimile Transmissions
  - Television Experiments
  - Inspection of stations
  - Avoidance of interference
  - Quality of transmission
  - Transmitter power
  - Antenna gain
  - Use of satellites and repeaters; accessing a repeater
4. General Provisions :
  - Use of stations in the Amateur Service
  - Prohibited Traffic
  - Licensee Responsible for operation of station
  - Secrecy of Communications
  - Log Keeping
  - Change of address of Amateur Station
  - Mobile Operations (Land, Maritime & Aeronautical)
  - Emergency Amateur Networks



Call Signs or Identifications  
Liability for breaches of Law  
Offences against regulations/rules  
Licensee to Receive Distress Signals  
Recording and Replaying Transmissions  
Relaying of Transmissions

