

## Syllabus of the Hong Kong Radio Amateurs' Examination

### **Part 1: Written Examination**

#### **1. Regulations and Licensing Conditions**

- 1.1 Nature of Amateur Service and Amateur Satellite Service.
- 1.2 Types of Amateur Station Licence available in Hong Kong.
- 1.3 Purposes of Amateur Station Licences and Authority to Operate, and qualifications of holders.
- 1.4 Conditions (terms, provisions and limitations) laid down in the Amateur Station Licences including notes appended to them and the Schedules of frequencies, bands, power and types of transmissions.
- 1.5 ITU Radio Regulations relating to Amateur Services.
- 1.6 CEPT Regulations relating to Amateur Services.

#### **2. Interference**

- 2.1 Radio frequency interference; spurious emissions, harmonics and intermodulation, causes and methods of suppression; direct radiation from frequency determining and frequency changing stages (including synthesizers) of a transmitter, parasitic oscillations, key clicks, excessive sidebands due to overmodulation, excessive frequency deviation of fm transmitters.
- 2.2 Frequency stability; effects of poor frequency stability; out-of-band radiation, causes and methods of elimination.
- 2.3 Restriction of audio bandwidth, typical methods and their limitations.
- 2.4 Mains borne interference, causes and methods of suppression.
- 2.5 Types of filters; low frequency and radio frequency filters.
- 2.6 The requirements of frequency checking equipment.

#### **3. Operating Procedures and Practices**

- 3.1 Calling procedures in telegraphy and telephony: general calls to all stations and calls to specific stations.
- 3.2 Log-keeping: maintenance of a log in accordance with the licence requirements.
- 3.3 Use of satellites and repeaters: purposes, limitations, and methods of accessing.
- 3.4 Use of Q codes and other abbreviations appropriate to the Amateur Service
- 3.5 The reasons for band planning: advantages of band planning.
- 3.6 The use of phonetic alphabet: reasons for its use.
- 3.7 Safety precautions in amateur station: safety in operation and maintenance.

## **4. Radio and Electricity**

### **4.1 Basic theory**

- 4.1.1 Basic electrical terms, units and their meanings: charge, potential difference, e.m.f., current, resistance, conductance, susceptance, impedance, reactance, energy and power.
- 4.1.2 Important characteristics of conductors, semi-conductors and insulators; conductivity and resistivity; temperature coefficient of resistance.
- 4.1.3. Resistors: symbols, types, colour coding, tolerance, wattage ratings; resistors in series and parallel; Ohm's Law and applications.
- 4.1.4. Principles and action of fuses, circuit breakers and safety devices; safety precautions.

### **4.2 Electromagnetism**

- 4.2.1 The magnetic effects of an electric current.
- 4.2.2 Description of magnetization curve and hysteresis loop.

### **4.3 Inductance**

- 4.3.1 Electromagnetic induction: description of effects of self and mutual inductance, unit of inductance.
- 4.3.2 Inductors in series and parallel without mutual inductance.
- 4.3.3 Effects of inductance in ac circuits; meaning of inductive reactance.
- 4.3.4 Eddy currents, descriptive treatment of hf resistance, eddy-current screening.
- 4.3.5 Inductors: symbols, essential characteristics of inductors for transmitters, receivers, power, audio and radio frequencies; uses of laminations, dust-cores, air cores and ferrites.

### **4.4 Capacitance**

- 4.4.1 The basic capacitor, definition of unit of capacitance.
- 4.4.2 Capacitors in series and parallel.
- 4.4.3 Effects of capacitance in ac circuits; meaning of capacitance reactance.
- 4.4.4 Dielectric strength, breakdown voltage, absorption and losses; electrostatic shielding.
- 4.4.5 Capacitors: symbols; characteristics and uses of paper, ceramic, silvered mica, polystyrene, variable and preset, non-inductive, electrolytic and tantalum capacitors.

### **4.5 Alternating current**

- 4.5.1 Sinewave: definition of terms; amplitude, period and frequency, instantaneous, peak, peak-to-peak, rms and average values.
- 4.5.2 Power, reactance, impedance and resonance in ac circuits; simple explanation of terms; resonance, phase angle, phase difference, phase lead and lag, Q (magnification) factor, bandwidth and 3 dB points.
- 4.5.3 Calculations on resonant frequency in parallel and series circuits.
- 4.5.4 Decibel, application in power measurement.

### **4.6 Transformer**

- 4.6.1 Function and operation.
- 4.6.2 Transformer as a matching device.

## **5. Solid State Devices**

- 5.1 Semi-conductor diodes: symbols; elementary principles of semi-conductor diodes including zener diodes; electrical characteristics.

- 5.2 Transistors: characteristics and principles of operation of npn and pnp transistors; control of output current and voltage when transistors are used as audio-frequency and radio-frequency amplifiers.
- 5.3 Use of solid state devices, including integrated circuits, in radio equipment as:
  - a. oscillators (crystal and variable frequency types),
  - b. amplifiers (audio-frequency and radio-frequency types),
  - c. frequency-changers,
  - d. frequency multipliers,
  - e. demodulators,
  - f. typical power supply circuits; power rectification; single-phase half-wave, full-wave and bridge connections; smoothing and voltage stabilization systems.

## **6. Logic Circuits**

- 6.1 Counting systems: decimal, binary; codes: binary, binary coded decimals.
- 6.2 Basic gates: AND, OR, NOT, NAND and NOR functions; symbols; simple Boolean algebra; truth tables.

## **7. Receivers and Transmitters**

### **7.1 Receivers**

- 7.1.1 Principles of reception of continuous wave, double sideband and single sideband and frequency modulated signals in terms of radio frequency amplification; frequency changing (where appropriate); demodulation or detection; automatic gain control; audio amplification: the superheterodyne principle of reception.
- 7.1.2 Advantages and disadvantages of high and low intermediate frequencies; adjacent channel and image frequency interference and their avoidance; capture effect.
- 7.1.3 Sensitivity and selectivity.
- 7.1.4 Radio frequency amplifiers; tuned circuit, gain, frequency response, linearity.
- 7.1.5 Audio frequency amplifiers; coupling; emitter follower; phase splitters; negative feedback; decoupling; power amplifiers.
- 7.1.6 Typical receivers; use of a beat frequency oscillator; characteristics of a single sideband signal and the purpose of a carrier insertion oscillator.

### **7.2 Transmitters**

- 7.2.1 Oscillators used in transmitters; principles of variable frequency and crystal controlled oscillators; factors affecting frequency stability.
- 7.2.2 Transmitter stages: operation of frequency changers, frequency multipliers, high and low power amplifiers (including linear types). Transmitter tuning and adjustment.
- 7.2.3 Methods of keying transmitters for telegraphy; advantages and disadvantages.
- 7.2.4 Voice operated controls.
- 7.2.5 Methods of modulation and types of emission in circuit use including single sideband and frequency/phase modulation; emissions in the A3E, J3E, F3E and G3E modes; relative advantages: adjustment of level of modulation.

## **8. Propagation and Antennae**

- 8.1 Explanation of basic terms: ionosphere, troposphere, atmosphere, field strength, polarization, maximum usable frequency, critical frequency, skip distance.
- 8.2 Generation of electromagnetic waves; relationship between electric and magnetic components.
- 8.3 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.
- 8.4 Ground wave, ionospheric and tropospheric propagation.
- 8.5 Fade out and types of fading: selective, interference, polarization, absorption and skip.
- 8.6 Velocity of radio waves in free space; relationship between velocity of propagation, frequency and wavelength; calculation of frequency and wavelength.
- 8.7 Receiving and transmitting aerials; operation and construction of typical aerials including multiband and directional types; their directional properties. Coupling and matching.
- 8.8 Effects of moisture and dirt on insulators; insulation breakdown.
- 8.9 Aerial feeders; open and coaxial types.
- 8.10 Transmission lines; balanced and unbalanced feeders; elementary principle of propagation of radio waves along transmission lines; velocity ratio, standing waves.

## **9. Measurement**

- 9.1 Types of instruments used in radio work for the measurement of ac, dc, and rf voltages and currents; errors in measurements.
- 9.2 Measurement of
  - a. dc power input to power amplifiers.
  - b. rf power output of power amplifiers.
  - c. current at radio frequencies.
- 9.3 Purposes, operation and use of absorption wavemeters, crystal calibrators, heterodyne wavemeters and frequency counters; relative accuracy.
- 9.4 Dummy loads, their purpose, construction and use in tuning transmitters.
- 9.5 Use of standing-wave ratio meters.
- 9.6 Use of oscilloscope to examine and measure waveform and monitor the depth of modulation.
- 9.7 Use of dip oscillator.

## **10. Basic Knowledge of Types of Amateur Service**

- 10.1 RTTY
- 10.2 Packet Radio
- 10.3 Facsimile
- 10.4 Slow Scan Television
- 10.5 Satellite

## **Part 2 - Amateur Morse Test**

Messages for the receiving and sending tests are composed of the following characters in Morse code:

Plain language : English alphabets from A to Z

5-character code groups : English alphabets from A to Z

5-figure groups : Figures from 0 to 9