Egyptian Meteorological Authority
(EMA)

World Meteorological Organization
(WMO)

World Meteorological Organization
Regional Trainig Center / Cairo

WMO RTC / Cairo - Egypt
Training Courses
Part 1

Cairo
Dec 2014
(2014-2018)

Table of Contents

INTRODUCTION

The courses are of various standards, some being designed for the newcomer to Meteorology and Hydrology. The primary purpose of most courses is to qualify the trainee for the duties which are expected to be undertaken by him as a member of a meteorological and hydrological service.

he Egyptian Meteorological Authority provides professional training for its meteorological staff. Many of the courses are-open to other Meteorological staff from other meteorological services.

A courses in this booklet have been prepared in the light of WMO publication (Guidelines for the education and training of meteorological personnel) (**WMO-No.258 ,No. 1083)**[*]. All training courses are given in Arabic or English, according to the requirement of training, under the supervision of the WMO RTC/Cairo, within the premises of the Egyptian Meteorological Authority.

Computer and Internet Lab.

[*] WMO-No. 1083 ,2012:Implementation of Education and Training Standards in Meteorology and Hydrology Volume I – ,Meteorology, World Meteorological Organization WMO

The innovation in this issue is to complete the follow up of the new classification of WMO for meteorological personnel in levels and duties, taking into consideration the concept of continuous training. The course reference number is composed in an objective manner using one or more from the following abbreviations:

M	**For meteorologist**
MT	**Meteorological Technicians**
E	**Electronics**
j	**Junior level**
m	**Medium level**
s	**Senior level**

Candidates from other countries can be admitted, subject to approval, for training at a standard rate, a reduced rate, or free of charge. Admittance of the trainees from these countries to the various courses could be achieved by one of the following means:

1. **The UNDP fellowship included in the Country programme.**
2. **The World Meteorological Organization Programme.**
3. **The country's national funds.**

The Egyptian Meteorological Authority would consider favourably granting short and long term fellowships in case none of the above facilities could be exploited, within the limits of the assigned budget.

Inquiries and requests for places on particular courses should be addressed-as early as possible-to the following address:

The Chairman, Board of Directors
Egyptian Meteorological Authority
Qoubry Al-Qoubba
P.O. Box 11784
Cairo -*Egypt.*

Tel. +(202) 26830069 - 26849860 **Fax. +(202) 26849857**

E-mail: ema.support@ema.gov.eg

At the termination of each course a report is issued to each participant, to reflect the activities of the trainee during the period of the course and the results achieved by him through his training; with a certificate recording his grades in the final examination.

Historical WMO RTC / Cairo, Egypt

February 1965 the Institute of Meteorological Research and Training was designated with the help of UNDP. The Executive Council (EC)- 20 of the World Meteorological Organization (WMO) agreed in 1968 to announce the institute as a Regional Meteorology Training Center(RMTC) for Meteorological Instruments for English speaker in Africa (RA I)

The EC– 41 in 1989 assigned the institute as a Regional Meteorological Training Center (RTC-Cairo) for all meteorological activity according to WMO Classification

At 2009 the agreement between WMO and EMA was revised in order to recalled the WMO RMTC/ Cairo to Regional Training Center (RTC-Cairo) on meteorology and hydrology for English and all Arab countries

Capabilities and infrastructure

1- RTC/Cairo has the advantages of using the available Remote sensing facilities real exist in the Met. Authority as in table

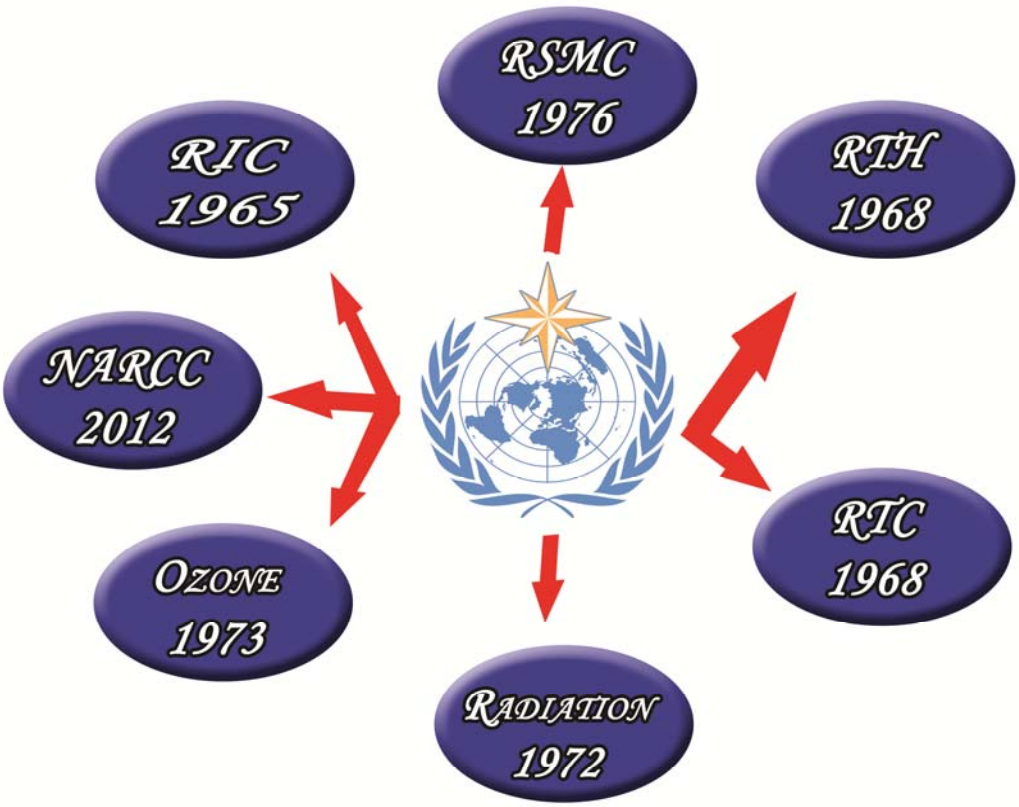
Item	Description	
1.	Eumetsat Second Generation (MSG)	
2.	High Resolution Picture Transmission (HRPT)	
3.	Messier Vision	
4.	Automatic weather Observation System (AWOS)	
5.	Agro. Met. Weather Observation	
6.	Upper air GPS	
7.	Upper Air radio theodolite	
8.	Claysys	
9.	Data collection system	
10.	GTS & WIS	
11.	Pressure champers	
12.	Temperature champers	
13.	Humidity champers	
14.	Simi stander barometer (mercury)	
15.	Simi stander parameter digital	
16.	Standard data accusation system	
17.	Satellite up & down link simulation	
18.	Electronic lab	

19.	Transducer lab	
20.	Numerical Weather Production NWP lab	

2- From 1968 to 2013, the WMO RTC/ Cairo, Egypt provided about 120 basic training programs for meteorologist and meteorological Technician (2007 trainees) also provided about 125 training programs for all related field programs in fields of military, aviation ,agriculture, environment and communication (1671 trainees),therefore WMO RTC/ Cairo trained more than 3678 trainees from 30 countries of different region of the world

3- WMO RTC/ Cairo obtained quality management certification (ISO 9001:2008)*

4- EMA has other 7 WMO Regional Centers which are content to WMO RTC/ Cairo



1- METEOROLOGIST

Course reference number : Mj-01

Level : JUNIOR -Level

Objective : To serve as synoptic forecaster in general and aeronautical forecaster in particular. To be able to study weather cases and issue necessary reports.

Qualifications : BSc. Degree in Physics or mathematics.

Duration : 40 Weeks .

SYLLABUS

Introduction

Historical context. Outline the scientific and technological advances that have contributed to the development of meteorology and its applications, brief introduction to the aims and functions of the international organizations in the field of meteorology and in particular that of the WMO, the role of meteorological services, the Egyptian Meteorological Authority, structure and functions of its main scientific and technical division.

Mathematics

Differential and integral calculus, Vectors and matrices, Differential equations.

Physics

Waves. Explain the fundamentals of wave motion, including the concepts of reflection, refraction and diffraction, phase and group velocities, wave dispersion and wave breaking and Optics. Explain the concepts of reflection, refraction, diffraction and scattering of light.

Complementary subjects

– **Basic physical chemistry**: Explain, using chemical nomenclature where appropriate, the basic concepts used in physical chemistry (including elements, molecules, compounds, bonds, chemical reactions and reaction rates), and describe the properties of gases and the key chemical reactions and cycles affecting the chemistry of the troposphere and stratosphere;

– **Basic oceanography**: Describe the general circulation and thermal structure of the oceans, explain the dynamical processes involved in producing ocean currents, tides and waves, and describe how measurements of temperature and salinity are taken;

– **Basic hydrology:** Describe the hydrological cycle, explain the factors determining runoff, groundwater and surface water resources and the water balance, describe how

hydrological measurements are made (precipitation, evaporation, soil moisture, river flow, groundwater, etc.), and identify the causes of different types of flooding;

– **Basic geography**: Describe the main geographical characteristics of the region of responsibility, including local terrain and local demographics, and describe map projections commonly used in meteorology;

– **Basic ecology:** Describe the major cycles of the biosphere (with emphasis on the carbon and water cycle) and the influence of human activity on those cycles (for example, destruction of rain forests and melting of permafrost).

TOPICS IN ATMOSPHERIC SCIENCES

Physical meteorology

Atmospheric composition, radiation and optical phenomena

Learning outcomes – able to handle:

– **Atmospheric structure:** Describe the vertical structure of the atmosphere in terms of its constituents,

temperature and moisture content;

– **Atmospheric composition:** Explain the composition of the atmosphere, including trace gases, aerosols, dust and volcanic ash, and pollutants;

– **Radiation in the atmosphere:** Use a basic knowledge of radiation transfer theory to explain the effect of surface conditions (including snow and ice) and atmospheric constituents (including aerosols, water vapor, clouds, greenhouse gases and reactive gases) on the incoming and outgoing radiation;

– **Global energy balance:** Relate the Earth's climate and its latitudinal and temporal variation to the energy balance at the Earth's surface, variations in the solar flux and the Earth's orbital characteristics;

– **Optical phenomena:** Explain the transparency of the atmosphere and the origins of common optical phenomena (rainbows, haloes, coronas, sky color, cloud color, etc.) and describe the meteorological conditions favorable for their occurrence.

-Thermodynamics and cloud physics

Learning outcomes – able to handle:

– **Applied thermodynamics:** Apply the Laws of Thermodynamics, with emphasis on understanding the concept of an air parcel, describing adiabatic processes and deriving dry and saturated adiabatic lapse rates and the associated conserved quantities;

– **Atmospheric moisture:** Define the parameters used to represent the amount of moisture in the atmosphere, explain their physical meaning, how they are related and how they are measured, explain the change of phase process, and determine the effect of water on the thermodynamic processes within the atmosphere;

– **Atmospheric stability:** Explain the basic features of a stable, neutral, conditionally unstable, potentially unstable and unstable atmosphere, identify the environmental conditions that can produce various stabilities, and explain the physical basis of commonly used stability parameters;

– **Thermodynamic diagrams:** Use a thermodynamic diagram to analyze atmospheric processes, including assessing atmospheric stability, determining common parameters used to describe the state of the atmosphere (including cloud parameters), and interpreting the key features of a sounding;

– **Clouds and precipitation:** Describe and explain the microphysical processes leading to the formation and dissipation of cloud droplets, the growth and dissipation of warm

and cold clouds, and the formation and growth of rain and solid precipitation particles, and describe the macroscopic structure of warm and cold clouds;

– **Electrical phenomena:** Explain the mechanisms causing electrical phenomena that occur in the atmosphere (for example, cloud-to-ground and cloud-to-cloud lightning), and describe the meteorological conditions favorable for their occurrence;

– **Formation of atmospheric hydrometeors:** Describe the synoptic and Mesoscale conditions and local processes that produce the various cloud types, precipitation types, icing, dew, frost and the various types of fog.

Boundary-layer meteorology and micrometeorology

Learning outcomes – able to handle:

– **Turbulent processes:** Describe the fundamental turbulent processes in the atmospheric boundary, including laminar and turbulent flows, mechanisms for generating turbulence, dissipation, decomposition of the fields into mean and fluctuating parts, statistical description of turbulence, and turbulent transport of mass, heat, moisture and momentum;

– **Surface energy exchanges:** Describe the energy budget near the Earth's surface and explain the energy exchange processes in the surface layer;

– **Boundary layer variations:** Use knowledge of turbulence and surface energy exchanges to explain the evolution and diurnal variation of the boundary layer, with emphasis on the conductive transfer from the underlying surface and the role of radiation transfer in determining the behavior of the boundary layer;

– **Boundary layer profiles:** Use knowledge of turbulence and surface energy exchanges to explain the typical profiles of meteorological variables in stable, neutral and unstable conditions;

– **Local winds:** Explain the impact on boundary layer flows of the terrain, coastline and urban areas, including thermally induced circulations (for example, sea and land breezes, lake effects and valley winds);

– **K theory :** Explain how K theory is used to modify the equations of motion to take account of turbulence, explain the origin and significance of the Ekman spiral, and derive an expression for the vertical structure of the wind in the surface layer using the mixing-length hypothesis;

– **Measuring techniques:**
Describe the techniques used to measure boundary-layer properties, including air quality;

– **Air contaminants:**
Describe the common contaminants and pollutants affecting air quality and their major sources and sinks, along with their measurement, behaviour (including chemical and photochemical reactions and dry and wet deposition), and dispersion in the boundary layer, and explain how meteorological conditions, including stability, affect air quality, visibility and the dispersion of plumes.

Conventional observations and instrumentation

Learning outcomes – able to handle:

– **Surface measurements:** Explain the physical principles used in instruments to make surface measurements of temperature, moisture, pressure, precipitation, wind, cloud height, visibility, sunshine and radiation, and wave height, and the limitations and sensitivities of those instruments, and describe the way cloud and weather types are classified;

– **Upper-air measurements:** Explain the physical principles used in instruments to make upper-air measurements of geographical position, pressure, temperature, moisture and

wind as well as ozone and other atmospheric constituents (for example, dust and volcanic ash);

– **Characteristics of instruments:** Describe, compare and contrast the characteristics of various instruments used to make surface and upper-air measurements of atmospheric parameters;

– **Instrument errors and uncertainty:** Explain the common sources of error and uncertainty in standard instruments and observing techniques, the methods of estimating the confidence in a particular measurement, and the need to take account of the representativeness of an observation;

– **Standards of instrumentation:** Explain the importance of national and international standards of measurement, and compliance with best practice for the accurate calibration of instruments;

– **Use and limitation of observations:** Describe the uses of conventional observations and their limitations;

Remote sensing

Learning outcomes – able to handle:

– **Radiation measurements:** Describe the principles behind the radiation measurements used for passive and active remote sensing, and how usable information can be derived from remote-sensing data, including the limitations and sources of errors/uncertainty;

– **Passive sensing systems:** Explain how passive sensing systems are used to provide digital data (such as visible, near infrared, infrared and water vapor imagery channels) and derived information about surface temperature and lightning, and atmospheric properties (including temperature, humidity, wind and atmospheric constituents);

– **Active sensing systems:** Explain how active sensing systems, such as radar, LIDAR and SODAR, are used to provide quantitative and qualitative information about atmospheric parameters such as temperature, humidity, cloud, precipitation (rate and type), wind speed and direction, turbulence and phenomena such as thunderstorms, microburst and tornadoes;

– **Satellite sounding systems:** Describe the orbital characteristics, accuracy, sampling limitations, use and limitations of various satellite sounding systems;

– **Radar measurements:** Explain the physical principles behind weather radar, including pulsed-Doppler radar, signal characteristics, how the radar information is processed, and the effect of meteorological factors on the propagation and attenuation of radar waves in the atmosphere;

– **Aircraft and marine systems:** Explain how aircraft, ships and buoys can be used to obtain atmospheric and oceanic information using remote-sensing systems.

Dynamic meteorology

– **Equations describing large-scale atmospheric flows:** Explain the physical principles underlying the equations that describe large-scale atmospheric flows (i.e., the primitive equations), including deriving the apparent and real forces acting on a fluid in a rotating frame of reference, and formulating the horizontal equation of motion;

– **Pressure coordinates:** Cast in pressure coordinates the primitive equations that govern the evolution of large-scale atmospheric flows, and state the advantages of using this coordinate system;

– **Scale analysis and balanced flows:** Apply scale analysis to determine the dominant processes operating in various examples of fluid flows, and derive the equations describing

balanced flows (including inertial, cyclostrophic, geostrophic and gradient flows), hydrostatic equilibrium and thermal wind balance;

– **Ageostrophic motion:** Use the equations of motion to explain the causes and implications of Ageostrophic flow, including the effect of friction;

– **Vorticity and divergence:** Explain the concepts of divergence, vorticity and potential vorticity, describe the mechanisms for generating changes in these parameters, and determine the relationship between divergence in the horizontal wind and vertical motion;

– **Quasi-geostrophic flow:** Explain the approximations and assumptions involved in deriving the quasigeostrophic system of equations, outline the derivation of the geopotential tendency and omega equations, provide a physical interpretation of the forcing terms in these equations, and use these equations to explain the distribution of vertical motion and geopotential tendency in a developing baroclinic system;

– **Waves in the atmosphere:** Use approximate forms of the equations describing fluid flows to describe the structure and propagation of sound waves, gravity waves and Rossby waves;

– **Baroclinic and barotropic instability:** Explain the conceptual model used to describe baroclinic and barotropic instability.

Numerical weather prediction (NWP)

– **NWP data assimilation:** Explain how information from observing networks and systems is obtained and prepared for use in an NWP model, and explain the principles behind objective analysis, data assimilation (including 3D-Var and 4D-Var) and initialization;

– **NWP forecast models:** Describe the key components of an NWP model (including the prognostic variables, physical laws, and how physical processes are parameterized), and explain the difference between types of models (for example, spectral versus grid-point and hydrostatic versus non-hydrostatic models);

– **Strengths and weaknesses of NWP:** Assess the strengths and weaknesses of NWP and the reasons why there are limits to atmospheric predictability;

– **Ensemble forecasting:** Describe the principles behind ensemble forecasting and how such an approach can be used for short-, medium- and long-range forecasting;

– **Monthly to seasonal forecasting:** Explain the scientific basis of monthly, seasonal and intra-annual forecasting;

– **Downscaling:** Describe the techniques used to provide detailed regional atmospheric information based on the output from global models;

– **Post-processing and applications:** Describe the techniques used for post-processing NWP output (for example, use of model output statistics) and some of the applications driven by NWP output (for example, wave and crop yield models).

Synoptic and Mesoscale meteorology

Mid-latitude and polar weather systems

Learning outcomes – able to handle:

– **Weather systems:** Explain how mid-latitude and polar weather systems differ from those in the tropics;

– **Modification of bodies of air:** Explain how bodies of air can be modified by the environment, the resulting characteristics of the air, and the ways in which the modifications can affect weather at distant locations through air movement;

– **Fronts:** Use knowledge of physical processes to describe the characteristics of warm, cold and stationary and occluded fronts, how these fronts are related to synoptic fields, and the three dimensional nature of frontal boundaries;
– **Mid-latitude depressions:** Apply physical and dynamical reasoning to explain the life cycle of mid-latitude depressions in terms of the Norwegian cyclone model, including the three-dimensional structure of a developing depression and the air flow through the depression;
– **Jet streaks and jet stream:** Apply physical and dynamical reasoning to explain the development, structure and impact of jet streaks and the relationship between the jet stream and the development of mid-latitude depressions;
– **Synoptic-scale vertical motion:** Diagnose synoptic-scale vertical motion in mid-latitude weather systems (for example, by considering a geostrophic motion, using the Petterssen or Sutcliffe Development Theory or applying the omega equation);
– **Cyclogenesis:** Apply knowledge of dynamical processes to explain Cyclogenesis and the factors contributing to explosive Cyclogenesis;
– **Frontal structure and Frontogenesis**: Explain the structure and dynamical characteristics of fronts, the relationship between Frontogenesis and vertical motion, and the processes causing upper-level Frontogenesis;
– **Polar weather systems:** Explain the characteristics and formation of polar weather systems, including katabatic winds, barrier winds and polar lows;
– **Extreme weather:** Describe the weather, with emphasis on any extreme or hazardous conditions, that might be associated with mid-latitude and polar weather systems and the likely impact of such conditions;
– **Limitation of conceptual models**: Analysis recent and/or historic weather events to assess the extent to which theories and conceptual models of mid-latitude and polar weather systems resemble reality.

Tropical weather systems

Learning outcomes – able to handle:
– **General circulation in the tropics:** Describe the general circulation in the tropics and its seasonal variation in terms of the temperature, zonal wind, meridional motions, humidity and sea-level pressure;
– **Main tropical disturbances:** Describe the main tropical disturbances and their temporal variability, including the ITCZ, tropical waves, trade inversions, trade winds, tropical/sub-tropical jet streams, cloud clusters, squall lines, tropical depressions, sub-tropical ridges and upper-level anticyclones;
– **Analysis of tropical flows:** Describe the techniques used to analyze tropical flows, including the depiction of streamlines and isotachs, and the identification of areas of convergence/divergence;
– **Weather systems:** Explain how tropical weather systems differ from those in mid-latitudes and polar regions;
– **Tropical waves:** Describe the various types of tropical wave (including Kelvin waves, equatorial Rossby waves and Madden-Julian Oscillation) and their relationship to organized convection and cyclogenesis;
– **Tropical cyclones:** Apply physical and dynamical reasoning to explain the structure and characteristics of tropical cyclones, the main dynamical processes involved in their development, and the techniques used to forecast the development and evolution of tropical storms;
– **Monsoon:** Apply physical and dynamical reasoning to explain the structure and characteristics of monsoons and the main dynamical processes involved in their development;

– **Ocean-atmosphere coupling:** Describe the role of ocean-atmosphere coupling with emphasis on the theoretical basis and impact of El Niño-Southern Oscillation (ENSO);
– **Extreme weather:** Describe the weather, with emphasis on any extreme or hazardous conditions that might be associated with tropical weather systems (including tropical cyclones and monsoons) and the likely impact of such conditions;
– **Limitation of conceptual models:** Analyze recent and/or historic weather events to assess the extent to which theories and conceptual models of tropical systems resemble reality.

Mesoscale weather systems

Learning outcomes – able to handle:

– **Mesoscale systems:** Describe the space and time scales associated with Mesoscale phenomena, and the differences in the dynamical processes that drive Mesoscale and synoptic scale systems;
– **Mesoscale features associated with depressions:** Explain the Mesoscale features associated with depressions (rain bands, dry lines, gust fronts, squall lines, etc.);
– **Gravity waves:** Apply physical and dynamical reasoning to explain the structure and formation of Mesoscale gravity waves;
– **Convective systems:** Apply physical and dynamical reasoning to explain the structure and formation of isolated convective systems such as thunderstorms and convective storms (including single cell, multi cell and super cell storms);
– **Mesoscale convective systems:** Apply physical and dynamical reasoning to explain the structure and formation of Mesoscale convective systems;
– **Orographic mesoscale phenomena:** Apply physical and dynamical reasoning to explain the structure and formation of orographic Mesoscale phenomena (lee waves, rotors, up-slope and down-slope winds, valley winds, gap flows, lee lows, etc.);
– **Extreme weather:**
Describe the weather, with emphasis on any extreme or hazardous conditions that might be associated with convective and Mesoscale phenomena, and the likely impact of such conditions;
– **Limitation of conceptual models:** Analyze recent and/or historic weather events to assess the extent to which theories and conceptual models of convective and mesoscale phenomena resemble reality.

Weather observing, analysis and diagnosis

Learning outcomes – able to handle:

– **Monitoring and observing the weather:** Monitor the weather, make a basic surface observation using remote and directly-read instruments and visual assessments (including identifying cloud types, cloud amount and weather type), explain the reasons for the visual assessments, and explain the underlying causes of a variety of weather phenomena that are visible from the Earth's surface;
– **Processing observations**: Describe how observations are quality-controlled, coded and distributed.
– **Synoptic analysis and interpretation:** Analyze and interpret synoptic charts and soundings plotted on a thermodynamic diagram, and describe the limitations of the observations used in the analyses;
– **Integrating conventional and remote-sensing data:** Integrate remote-sensing data and synoptic observations to identify synoptic and mesoscale systems and diagnose the weather situation through relating features found in radar and satellite imagery to features observed from other data sources;

– **International collaboration:** Describe the role of international collaboration in the making and sharing of observations, with emphasis on the World Weather Watch, WMO Global Observing System and WMO Information System (including the Global Telecommunications System).

Weather forecasting

Learning outcomes – able to handle:

– **Local weather:** Describe factors affecting local weather (for example, the effect of orography and large bodies of water on cloud and precipitation, or the effect of land surface types);

– **Forecast process:** Describe the main components of the forecast process, including observation, analysis, diagnosis, prognosis, product preparation, product delivery and product verification;

– **Types of forecasting methods:** Explain the advantages and disadvantages of preparing forecasts based on persistence, extrapolation and numerical weather prediction (NWP), and describe the role of the forecaster;

– **Conceptual models:** Apply conceptual models in making short-range forecasts and interpreting longer range forecasts;

– **Practical forecasting:** Combine information from various sources to explain the current weather conditions, and use basic forecasting techniques, including the interpretation of NWP output, to forecast atmospheric variables (for example, maximum and minimum temperature, wind, and precipitation type and intensity) at a specific location.

Service delivery, Annex III

Learning outcomes – able to handle:

– **Function of National Meteorological Services:** Describe the function of National Meteorological Services in monitoring and forecasting the weather and the role of other service providers;

– **Key products and services:** Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information, that are provided to the public and other users, and describe how the products and services are used (for example, for decision-making and managing risk);

– **Quality of products and services:** Explain the basic techniques used to assess the quality of products and services;

– **Benefits and costs of meteorological services:** Identify the economic and social impacts of meteorological services upon a country and their key user sectors.

Climatology

Global circulation, climates and climate services

Learning outcomes – able to handle:

– **Components of the Earth system:** Describe the key components of the Earth system (i.e., atmosphere, oceans, land, cryosphere and solid earth);

– **Climate and weather:** Describe climate and how it differs from weather;

– **Climate data:** Describe how climate is measured and the uncertainty inherent in climate data, how climate data is analysed using statistics, and how climate can be measured using remote sensing;

– **Features of the global circulation:** Explain the main features of the global circulation of the atmosphere and oceans based on an understanding of the physical and dynamical process that are involved, and describe the global energy balance and the role of

the atmosphere and oceans in balancing the radiative heating differences between the equator and pole;

– **Regional and local climates:** Assess the factors that determine regional and local climates;

– **Classifying and describing climates:** Describe the techniques for classifying the climate, the principles behind these techniques, and the meaning and use of standard statistical variables used to describe climate;

– **Local climate:** Describe the climatology and seasonal changes of the region of responsibility and the way climatological information can be obtained and displayed;

– **Key products and services:** Describe the key products and services based on climate information that are provided to the public and other users, describe their inherent uncertainties and how the products and services are used (for example, for decision-making and managing risk).

Climate variability and climate change

Learning outcomes – able to handle:

– **Data to assess climate variations:** Describe the source and processing of data that is used to reconstruct past climates and assess changes in climate and atmospheric composition;

– **Observed climate variations:** Describe how the climate has changed in the recent past in the context of changes that have occurred more generally in the past and the techniques used for attributing the causes;

– **Atmosphere-ocean interaction:** Describe the various ways in which the atmosphere influences the oceans and the oceans influence the atmosphere;

– **Climate variability:** Apply physical and dynamical reasoning to explain the causes of internally generated climate variability (including examples of teleconnections , anomalies, and the climatic effects of major regimes such as the Madden-Julian Oscillation, North Atlantic Oscillation, and El Niño-Southern Oscillation);

– **Climate change:** Apply physical and dynamical reasoning to explain the causes of externally-forced climate change (including the influence of human activity), and the source of uncertainty in understanding these causes;

– **Impact, adaptation and mitigation:** Assess the major impacts of climate variability and change, and outline the adaptation and mitigation strategies that are applied in response to current and projected changes in the climate;

– **Climate models:** Explain the differences between climate models and those used for weather prediction, explain why there are uncertainties in climate predictions, describe how climate predictions can be verified, and explain why there are differences between statistical intra-annual forecasts and climate model predictions.

Satellite images Interpretations and radar data

Fundamental ideas in Radiation transfer and satellite remote sensing, Types of meteorological satellite, Satellite characteristics, Dissemination of satellite imagery, Basic interpretation of VIS imagery, Basic interpretation of IR imagery, Basic interpretation of WV imagery, Basic interpretation of 3.7 μm (channel-3) imagery. MSG unit facilities, HRPT unit facilities, RGB Technique. Cloud types, Cloud patterns, synoptic and mesoscale systems, and special features(fog, sand, volcanic ash, dust, fires, etc.). The Earth's surface, and Atmospheric pollutants. Waves and fronts. Position of Jet stream, types of cyclogenesis, ITCZ, cyclones and anticyclones.

– Interpreting radar data: Interpret common radar displays, including use of enhancements and animated imagery, to identify features associated with convective and mesoscale processes;

Meteorological codes

Synop, METAR, SPECI, TEMP, TAF, ARFOR, ROFOR, SIGMET, AIRMET, WARNING, SIGWX chart.

Aeronautical Meteorology

Describe the extent to which hazardous weather systems affecting the region of responsibility can be forecast, and explain the importance of assessing the risk of hazardous weather, issuing prompt and accurate warnings, and of understanding the potential impact of hazardous weather on society, Aircraft icing, turbulence, other hazardous phenomena, meteorological aspects of flight planning, definitions, procedures for meteorological services for international air navigation, air traffic services, aerodromes, operation of aircraft, aeronautical information services, aeronautical telecommunications, WMO documentation and ICAO documentation.

Selected topics

Seminars on points of interest under supervision (Ozone, AgroMet, Satellite images, climate, synoptic situations, environment…….etc.)

Laboratory Exercises

- Plotting and analysis of surface and upper level charts, evaluation of geostrophic wind, non-geostrophic wind and accelerations, geostrophic vorticity, geostrophic advection of different fields.
- Construction of thickness charts by using graphical methods, evaluation of thermal wind.
- Analysis of thermodynamic diagrams.
- Jet stream and tropopause analysis.
- Construction of vertical space and time cross sections for different meteorological elements.
- Coding and decoding of surface and upper air observations.
- *Written communications.* Prepare written communications within specified time limits in a concise, accurate and comprehensible way, including use of word processing and presentation programs.
- *Oral presentations*. Make presentations within specified time limits in which the content and style of delivery accurately conveys information in a way that is understood by the audience.
- *Teamwork*. Demonstrate an understanding of the different roles and functions in a team.
- *Accessing and obtaining information*. Find meteorological information using libraries, databases and internet searches.
- programming: Use basic computer programming principles, and construct a simple computer program for analyzing or displaying data;
- Data processing: Perform data processing and statistical analysis using spreadsheets and databases;

- Geographic Information Systems: Discuss the components and functionality of a GIS, describe the potential uses of a GIS along with its benefits and shortcomings, and outline data quality issues involved in using a GIS;
- Creating and publishing online material: Create, publish and update a basic webpage.

LECTURE ROOM NO.1

2- AERONAUTICAL METEOROLOGICAL FORECASTER

Course reference number : Mm-02

Level : Medium -Level

Objective : He will be able to achieve the competences for his job as AMF and he will be able to supervise the work of AMT.

Qualifications : Mj-01 and 2 years experience as a Meteorologist

Duration : 12 Weeks

SYLLABUS

Introduction

The Egyptian Meteorological Authority, structure and functions of its main scientific and technical division.

Competencies of AMP

- AMF Competencies
- overview of AMT Competencies

Meteorological satellite images interpretation

- Introduction to satellites meteorology
- Satellite images
- Satellites images interpretation Such clouds- situations
- jet stream - fronts - volcanic ash- sand storm etc.
- The meteosat second generation of satellites images and its application in interpretation of images using RGB composition
- The study of different situations for the use of satellites meteorology .

Aeronautical meteorology

- review of various hazards to aviation such Aircraft icing, turbulence , thunder storm ,fog and volcanic ach
- explain the importance of assessing the risk of hazardous weather, issuing prompt and accurate warnings, , air traffic services.

Climate Change and climate variability

- Introduction to Climate
- Climate change, climate variability
- Indices and using it in daily forecasting preparation

CODE& Annex III

- Review of the code & Annex III
- The New in CODE &Annex III

Clouds physics

Clouds and precipitation, Electrical phenomena, Formation of atmospheric hydrometeors.

Assessment of AMP

- The different ways of assessment methods
- Practical application on different ways of assessment
- Competency Assessment Toolkit
- what the assessor should be have

Boundary-layer meteorology and micrometeorology

Learning outcomes – able to handle:

– **Turbulent processes:** Describe the fundamental turbulent processes in the atmospheric boundary, including laminar and turbulent flows, mechanisms for generating turbulence, dissipation, decomposition of the fields into mean and fluctuating parts, statistical description of turbulence, and turbulent transport of mass, heat, moisture and momentum;

– **Surface energy exchanges:** Describe the energy budget near the Earth's surface and explain the energy exchange processes in the surface layer;

– **Boundary layer variations:** Use knowledge of turbulence and surface energy exchanges to explain the evolution and diurnal variation of the boundary layer, with emphasis on the conductive transfer from the underlying surface and the role of radiation transfer in determining the behavior of the boundary layer;

– **Boundary layer profiles:** Use knowledge of turbulence and surface energy exchanges to explain the typical profiles of meteorological variables in stable, neutral and unstable conditions;

– **Local winds:** Explain the impact on boundary layer flows of the terrain, coastline and urban areas, including thermally induced circulations (for example, sea and land breezes, lake effects and valley winds);

– **K theory:** Explain how K theory is used to modify the equations of motion to take account of turbulence, explain the origin and significance of the Ekman spiral, and derive an expression for the vertical structure of the wind in the surface layer using the mixing-length hypothesis;

– **Measuring techniques:**
Describe the techniques used to measure boundary-layer properties, including air quality;

– **Air contaminants:**
Describe the common contaminants and pollutants affecting air quality and their major sources and sinks, along with their measurement, behaviour (including chemical and photochemical reactions and dry and wet deposition), and dispersion in the boundary layer, and explain how meteorological conditions, including stability, affect air quality, visibility and the dispersion of plumes.

Dynamic meteorology

Equations describing large-scale atmospheric flows, Pressure coordinates, Scale analysis and balanced flows, Ageostrophic motion, Vorticity and divergence, Quasi-geostrophic flow, Waves in the atmosphere, Baroclinic and barotropic instability

Numerical weather prediction (NWP)

-NWP data assimilation, NWP forecast models, Strengths and weaknesses of NWP, Ensemble forecasting, Monthly to seasonal forecasting, Downscaling, Post-processing and applications

- Numerical models outputs and it's used in forecasting

Synoptic , Tropical and Mesoscale meteorology

-Modification of bodies of air, Fronts, Mid-latitude depressions, Jet streaks and jet stream, Synoptic-scale vertical motion, Cyclogenesis, Frontal structure and Frontogenesis, Polar weather systems, Extreme weather, Limitation of conceptual models

Tropical weather systems

-General circulation in the tropics, Main tropical disturbances,
Analysis of tropical flows, Weather systems, Tropical waves, Tropical cyclones, Monsoon, Ocean-atmosphere coupling ,Extreme weather, Limitation of conceptual models,

Mesoscale weather systems

-Mesoscale systems, Mesoscale features associated with depressions, Gravity waves, Convective systems, Mesoscale convective systems, Orographic mesoscale phenomena, Extreme weather, Limitation of conceptual models.

QMS

- Understand the concept of TQM (total quality management) and how to apply.
- What is meant by ISO 9001 required .

Websites containing meteorology resources and Competency Assessment Toolkit

Prepare a working paper

Exams

Exams divided into two parts

1- Exam in subject represents background.
2- Prepare a work paper represented the competencies for AMF and AMT by apply QMS and Discuss it.

Note " this course is flexible and able to develop according the training needs of Participants and the previous assessment (feedback)".

3-SATELLITE IMAGES INTERPRETATION

Course reference number: Mj-03

Level : Special - level

Objective : To be able to use and interpret satellite Images in forecasting.

Qualifications : Mj-01 & 2 years Experience as a weather forecaster.

Duration : 4 Weeks

SYLLABUS

Introduction

Basic principles: Fundamental ideas in Radiation transfer and satellite remote sensing, Types of meteorological satellite, Satellite characteristics, Dissemination of satellite imagery, Basic interpretation of VIS imagery, Basic interpretation of IR imagery, Basic interpretation of WV imagery, Basic interpretation of 3.7 μm (channel-3) imagery.
Simple identification: Cloud types, Cloud patterns, The Earth's surface, Atmospheric pollutants.

Synoptic-scale cloud and moisture patterns

Introduction: Conveyor belts associated with fronts and waves
Interpreting large-scale patterns of cirriform cloud and moisture: Cirrus cloud bands, Cirrus shields, Deformation zone cirrus and moisture.
Interpreting patterns of cumuliform clouds: Locating thermal troughs, locating upper short-wave troughs, locating jet-stream axes, locating surface ridges.
Interpreting features associated with baroclinic troughs: Leaf, Comma, Vortex.

Fronts and waves

Classical cold fronts: Differences between classical and split fronts, Development of cold frontal cloud bands, Conceptual model, Guidance on analysis from imagery, Surface weather, Squall line development, Interaction with jet streaks.
Split cold fronts: Development of split frontal cloud bands, Features on satellite images, Surface and upper air analyses, Conceptual model and surface weather.
Warm fronts: The cloud band, Cloud development in the warm sector, 'Detached' warm frontal cloud, Precipitation distribution.

Instant (pseudo) occlusions: Synoptic scale , Mesoscale.
Synoptic-scale waves: Basic dynamical concepts, Features on satellite images, Examples.

Depressions in mid-latitudes

Cloud signatures preceding Cyclogenesis: identifying key components, upper-flow patterns from satellite images.
Types of Cyclogenesis: Evolutions from enhanced cumulus or comma, Evolutions from the main frontal cloud, Flat trough, confluent flow Cyclogenesis (cloud head).
Mid-latitude Cyclogenesis associated with tropical storms: Tropical storm regeneration, Cyclogenesis initiated by tropical storms, forecasting guidelines.
Occlusions and mature depressions: Occluded fronts, Cloud and weather in occluded depressions.
Non-deepening depressions: Clues from imagery, Upper-air patterns.
Polar lows: Weather associated with polar lows, Polar lows within a synoptic-scale cold core aloft, Polar low development within a surface trough, Comma cloud associated with an upper trough, Waves associated with shallow baroclinic zones, Reverse-shear polar lows, A polar-low-like vortex in the Mediterranean.

Convective cloud patterns

Convection initiated over oceans: Cloud patterns and their relation to atmospheric structure, further examples of maritime convection, Modifications near coasts.
Topographically induced convective cloud patterns: Convection associated with sea-breezes, Convection associated with land-breezes, Land-based convection near inland water bodies, Winter time cloud bands, The influence of initial cloud cover on subsequent convection, The influence of wet ground and vegetation on convection, The influence of cities on convection, Convection over elevated terrain, Orographically induced convergence zones and meso-scale vortices.
Thunderstorm outflow and convective interaction: Convective storm low-level outflow and arc cloud lines, Outflow boundaries and new thunderstorm development.
Organized meso-scale convective systems: Features in the pre-storm environment, Types of meso-scale convective systems, Life cycle and evolution of an MCS, Precipitation patterns in MCSs, Severe weather associated with MCSs, Summary of forecasting convection.

Fog and low cloud

Radiation fog and stratus: Detection of fog in the daytime, Distinguishing between fog and stratus, Detection of fog at night, Formation of fog and stratus within moisture boundaries, Guidelines on formation and detection of fog, Dissipation of fog and stratus: the role of inward mixing, Guidelines for forecasting dissipation of fog.
Sea fog: Daytime imagery, Nighttime imagery, Sea fog motion, the effect of coastlines and other meso-scale influences on fog.
Stratocumulus: The appearance of stratocumulus, The importance of stratocumulus, The physical environment and evolution of stratocumulus, The motion of stratocumulus, Satellite observations of

stratocumulus cloud-top temperature, Small-scale structure of stratocumulus.

Orographic and polar phenomena

Clouds generated by mountains: Lee waves and orographic cirrus, Inferring areas of turbulence, other examples.
Mountain barrier effects: föhn :The barrage cloud, Fog
Polar phenomena: Identifying clouds in polar imagery, High-latitude cloud types, Topographical phenomena, Vortices in the Polar Regions.

On job training

The participants will take an hour every day on job training using, MSG, MESSIER VISION in the main remote sensing center.

4- AN INTRODUCTION TO NUMERICAL WEATHER PREDICTION

Course reference number : Mj -04

Level : Special - level

Objective :
_Understanding the component of NWP cycle.
_ Discussing the advantages and disadvantages of numerical methods.
_ Preparing the student to best use of numerical weather model products.
_ Providing some programming skills, which enables the trainee to understand the dynamics of the atmosphere.

Qualifications : Mj-01 , 2 year experience as meteorologist

Duration : 3 weeks .

SYLLABUS

Introduction

– Historical overview
– Overview of NWP Cycle
–Atmospheric Observing Systems
– Errors in Meteorological Observation
– Quality Control of Data
– Objective Analysis
– Data Assimilation
– How to describe the continuum Atmosphere

Introduction to Finite Difference

– overview of Different numerical methods
– Advection and Oscillation Equations
– Finite Difference Concepts I: Taylor expansion, Truncation Error, Higher Order Quotient difference, Round off Error.
– Finite Difference Concepts II: Consistency, Convergence, Stability of Numerical Solution, Phase Error.
– Numerical Stability Domain of Dependence, Region of Influence, CFL condition.

Time Difference Schemes

– Two level Schemes
– Three level Schemes

Space Difference Schemes

– Centered Space Difference
– Uncentered Space Difference

Time-Space Difference Schemes

– Forward-Upstream scheme
– Leapfrog scheme
– Matsuno Scheme

Introduction to Ensemble Prediction

– Introduction to Chaos Theory
– The Uncertainties in NWP
– Lorenz Three Variable Model
– Applications

Introduction to Seasonal Prediction

– The atmospheric Predictability
– The role of Ocean Circulation
– What we can seasonally predict?

Intelligence Usage of NWP

– Some Misconceptions
– High resolution Modeling of Mesoscale
– Fog
– Dust storm
– The effects of Topography on wind
– Land/Sea Breaze

Verification and Validation of NWP

– review of some statistics
– Introduction of Verification
– Model Output statistics (MOS)
– Post-processing and MOS

Practice

Installing & running of WRF for NWP, Installing & running of RegCM .for climate applications

Numerical Weather Prediction Lab.

5- AN INTRODUCTION TO CLIMATE & CLIMATE MODELING

Course reference number : Mj-05

Level : Special -**Level**

Objective : This course provides an introduction to climate system, its modeling, and the climate change. The general circulations of atmosphere and ocean and their interactions will be discussed in some details. Some advanced topics like atmospheric oscillations and climate change will briefly be discussed in simple way.

Qualifications : MJ-01 , two year experience as meteorologist

Duration : **3 Weeks .**

SYLLABUS

Introduction to Climat System

– An Overview of Earth System
– Energy Cycle, hydrological cycle, others
– Atmospheric Composition and Structure.

General Circulation of Atmosphere

– Atmospheric Radiation
– Theories in General Circulation
  * Hadely Theory
  * Three Cell Model
  *Palmen Model
  * Vertical and Horizontal Circulation
– Observed Large Scale Patterns
– Practical Exercises
  * Using Grads and Reanalysis Data to drawing The Basic Large Scale Patterns

Climate Classification

- the climate classification

Ocean Circulation

– General Ocean Circulation
– Atmosphere-ocean interaction

Climate Variability

– Teleconnections
– Atmospheric Oscillations

* North Atlantic Oscillation
*El Nino-Southern Oscillation
*Madden-Julian Oscillation

Climate Change

– Introduction to Paleo-climate
– Natural and Anthropogenic Effects
– Green House Gases
– IPCC Reports
– Impact, adaptation and mitigation

Introduction to Climate Modeling

– Overview of Earth system Modeling
– Simulation and Scenarios'
– Climate Change Modeling

Egypt Climatology

– History of Climate Studies in Egypt
– Basics Climate Features

6- ENHANCE FORECAST ACCURACY BY USING NWP

Course reference number :	**Mj-06**
Level :	**Special- level**
Objective :	**Read, Interpret & use the products of NWP models to enhance weather forecast.**
Qualifications :	**Mj-01 & 2 years' Experience as a forecaster in any Forecasting Center.**
Duration :	**2 Weeks**

SYLLABUS

Introduction

General review on synoptic, physical & dynamical Met.

Numerical schemes

- Basic commands to deal with files and directory
- Introduction to shell programming
- Data types
- Input / Output files
- Finite difference
- Time schemes
- Statistical validation

Practice

Data analysis using NCL, CDO and NCO.

7-AGROMETEOROLOGIST

Course reference number : Mm-07

Level : Medium level

Objective : To qualify professional forecasters to serve in the field of agro meteorology.

Qualifications : Mj-01 & 2 years Experience in field of meteorology .

Duration : 12 weeks.

SYLLABUS

Introduction

General revision of the main topics of relevance such as radiation and climatology. Importance of weather and climate for agricultural production, national agrometeorological services functions and aims Of the WMO commission for Agricultural Meteorology (CAgM). Maintenance and calibration of the agrometeorological station instruments

Biological measurements

- Stages of crop developments (from plantation to harvest).
- Pests and diseases affecting agriculture crops.
- Crop modeling (growth, elongation, irrigation schedule, bests and disease
- Specific examples of biological / phonological observation .
- Practical training to the topics using locally row data.

Soil and its heat balance

- Exchange the temperature between the atmosphere and the soil.
- Transmission of temperature during the soil.
- Behavior of soil temperature at different depths during bare and grass soil.
- The importance of studying of soil temperature for agriculture.
- Practical training to the topics.

Radiation balance and its relationship with the soil

- Direct and diffuse components of solar short-wave radiation.
- Solar radiation, instruments, calibration, methods of observation, maintenance and data analysis.
- Practical training to the topics using locally row data.

Rainfall data analysis

- Methods of Rainfall data analysis.
- Dry and wet seasons (spells).
- Analysis of extreme values.
- Practical training to the topics using locally row data.

Hydrological cycle and its importance for Agro meteorology

- Water and vegetation.
- Water and crop index.
- Determine of water loss from land surface.
- Evaporation and evapotranspiration measurements.
- Comparison between evaporation equations.
- Practical training to the topics using locally row data.

Statistical computing

- Introduction to the statistics
- Descriptive statistics, correlation, regression and multiple regression, Analysis Of Variance, confidence interval, F-test, Q_square test, --- ect
- Rainfall data analysis.
- Dry and wet seasons (spells).
- Analysis of extreme values.
- Practical training to the topics using locally row data.
- Using statistics to perform agrometeorological weather report

Agro meteorological stations

- The aim of agrometeorological station
- Routine work of the agrometeorological station
- Agrometeorological station instruments.
- Automatic agrometeorological station.
- Quality control of agrometeorological data.
- Practical training to the topics

Laboratory and field exercises

Visiting to the agrometeorological station.

8- METEOROLOGICAL TECHNICIANS

Course reference number:	**MTj-08**
Level :	**JUNIOR -Level**
Objective :	**To qualify the participants in the field of meteorology to enable them to perform meteorological observations, meteorological measurements, weather monitoring, climate and how to do quality control for data. By this program, the participants have to be able to adapt themselves as appropriate in their future activities.**
Qualifications :	**Secondary school certificate (Science or Mathematics) and/or Electronic technician certificate.**
Duration :	**26 weeks**

SYLLABUS

Introduction

Historical context. Outline the scientific and technological advances that have contributed to the development of meteorology and its applications. The Egyptian Met. Authority (EMA) Structures and functions of its main scientific and technical divisions.WWW Functions.

Mathematic

Trigonometry, Logarithms , exponentials ,Vectors ,Algebra, Geometry and Coordinate geometry.

Physics

Kinematics, Work, energy and power, Phases of matter, Temperature, heat, kinetic theory of gases, Oscillations , waves,

Basic physical meteorology

Atmospheric composition and structure. Describe the composition of the atmosphere and explain its vertical structure.

Atmospheric pressure. Explain why pressure varies with height, explain the effect of temperature and humidity on the variation of pressure with height, and explain why pressure is often reduced to mean sea level.

Atmospheric temperature. Describe the heating and cooling effect of convection, advection, turbulence and evaporation/condensation, explain the effect of water vapor, cloud and wind on the surface air temperature, explain the diurnal variation in surface air temperature, and describe the main factors that affect the global distribution of surface air temperature.
Atmospheric humidity. Explain why humidity is important, explain the concepts of vapor pressure, saturated vapor pressure, wet-bulb temperature, dew point and relative humidity, and describe the factors that affect the rate of evaporation.
Atmospheric stability . Describe the causes of variations in atmospheric stability, explain the concepts of dry adiabatic lapse rate, saturated adiabatic lapse rate and environmental lapse rate, explain various types of stability (e.g., absolute, conditional, neutral), explain the role of temperature inversions, and describe how stability and instability develop.
Clouds, precipitation and thunderstorms. Explain why rising motion leads to the formation of clouds, describe the main mechanisms for the formation of clouds, describe the processes that produce precipitation.

Basic dynamic meteorology

Solve basic problems when a system is in equilibrium, solve basic problems using Newton's Second Law of Motion, and solve basic problems using the principle of the conservation of momentum. explain the concept of the following scale analysis ; Motion in a circle, Explain the concept of centripetal acceleration and describe circular orbits by relating the gravitational force to the centripetal acceleration; Basic Equations in Isobaric Coordinates; Balanced Flow; Wind. Explain why winds occur, describe the pressure gradient force and Coriolis force, and explain concepts of the geostrophic and gradient winds; describe the effect of friction on the wind, and explain the causes of common local winds caused by topography (e.g., sea/land breezes, foehn winds and katabatic/anabatic winds). Trajectories and Streamlines; The Thermal Wind ; Vertical Motion ; Surface Pressure Tendency ; The Circulation Theorem ; Vorticity

Aeronautical Meteorology

Aircraft icing ,turbulence, fog ,thunderstorm ,sand storm ,dust storm ,volcanic ash and tropical cyclones.

Radiation

Atmospheric optics and electricity. Explain the formation of rainbows, haloes, blue skies and lightning .Electromagnetic radiation and Electricity and electromagnetic induction. Explain the diurnal, latitudinal and seasonal variations in the radiation reaching the Earth's surface, describe the differences between short (solar) and long-wave (terrestrial) radiation, describe the processes affecting short- and long-wave radiation (i.e., reflection, scattering and absorption of radiation), outline the heat budget of the Earth's atmosphere, explain the greenhouse effect, explain the role of ozone in affecting ultraviolet radiation, and describe the heat balance at the surface and how it varies with latitude.

Basic oceanography& Basic geography

Describe the general circulation and thermal structure of the oceans, and describe how measurements of temperature, salinity and sea state are made. Basic geography. Describe the main geographical characteristics of the region of responsibility,including a description of the local terrain.

Basic hydrology.

Describe the hydrological cycle, identifying the key factors determining runoff, groundwater and surface water resources and the water balance, and describe how hydrological measurements are made (e.g., precipitation, evaporation, soil moisture, river flow, groundwater).

Basic Synoptic and mesoscale meteorology

Explain the concepts of high, low pressure, troughs and ridges and their associated weather, air mass (a the origin, characteristics, movement and modification of air masses) and fronts and jet stream(describe the relationship between jet streams and weather systems). Different types of charts used in forecasting office, different scales of motion. Describe the formation, evolution and characteristics of synoptic-scale and mesoscale tropical, mid-latitude and polar weather systems, and analyze weather observations. Describe the forecast process and the use made of the associated products and services , describe the principles behind numerical weather prediction (NWP), and interpret basic operational NWP output.Weather at a specific location. combination of effects acting on different time and space scales. Mid-latitude and polar weather systems. Main tropical disturbances. Describe the main tropical disturbances and their associated weather, including the ITCZ, tropical depressions, monsoons and El Niño-Southern Oscillation (ENSO). Mesoscale systems. Describe the formation and characteristics of important mesoscale features affecting the region of responsibility . Surface pressure diagrams. Identify the main synoptic features on surface pressure diagrams and the associated satellite and radar imagery, and describe the typical weather associated with those features. Upper-air diagrams. Describe different types of upper-air diagrams, including height charts on constant pressure surfaces, identify the main synoptic features on the diagram . *Aerological diagrams*. Describe the physical ideas that form the basis of aerological diagrams and perform basic operations on the diagram. Key products and services. Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information that are provided to the public and other users. Function of National Meteorological Services. Describe the function of National Meteorological. Key products and services. Describe the key products and services, including warnings of hazardous weather conditions, based on current and forecast weather information that are provided to the public and other users. Function of National Meteorological Services. Describe the function of National Meteorological
Services in monitoring and forecasting the weather and the role of other service providers.

Satellite and radar imagery

Remote-sensing systems. Describe the means by which remote sensing from ground and space (including use of satellites, radars, wind profilers, and aircraft, marine and lightning-detection systems) provides information about the atmosphere. Study the basic concepts of satellites types and images and describe the weather associated with those images.

Basic climatology

An individual achieving the learning outcomes dealing with basic climatology shall be able to:

– Describe the general circulation of the atmosphere and the processes leading to climate variability and change;

– Describe the use made of products and services based on climate information. Learning outcomes – able to handle:

– ***Features of the global circulation*:** Explain the main features of the global circulation of the atmosphere and oceans and their temporal (diurnal, seasonal, annual) variability;

– ***Regional and local climates*:** Explain the factors that determine regional and local climates;

– ***Classifying and describing climates*:** Describe the techniques for classifying the climate, including the Köppen method;

– ***Local climate*:** Describe the climatology and seasonal changes of the region of responsibility and the climatic trend in that region;

– ***Climate variability and climate change*:** Describe the difference between climate variability and climate change, describe the basic concepts behind the greenhouse effect and the basic science involved in human-induced climate change, and describe the basis for climate predictions;

– ***Seasonal forecasts*:** Outline the process and scientific basis for making seasonal forecasts;

– ***Climate data*:** Describe how climate data is captured, collected and quality-controlled in the meteorological service

– ***Climate statistics*:** Describe how climate data is analysed in terms of its distribution (for example, frequency and cumulative frequency), central tendency and variation;

– ***Key products and services*:** Describe the key products and services based on climate information that are provided to the public and other users.

Meteorological instruments and methods of observation

Explain the physical principles used in instruments to measure atmospheric parameters. Make basic weather observations. WMO Integrated Global Observing System. Describe the main components of the WMO Global observing System and WMO Information System (including the Global Telecommunications System) that are used for making and transmitting meteorological and other environmental observations on a global scale using surface-based and space-based systems. Siting of instruments. Describe the factors that need to be taken into account when siting surface instrumentation. Surface instrumentation. Explain the physical principles used in instruments to make surface measurements of temperature, moisture, pressure, precipitation, wind, cloud height, visibility, sunshine and radiation (including instruments used in automatic weather stations),

describe how these instruments operate, and outline the kinds of errors that might occur. Clouds. Describe the main cloud types, their characteristics, usual height range, and associated weather phenomena.

Weather phenomena. *Describe the various weather phenomena considered when taking a visual surface observation, describe their characteristics and explain their formation. Monitoring and observing the weather. Monitor the weather, make surface observations using remote and directly-read instruments and visual assessments (including identifying cloud types, cloud amount and weather type), and explain the reasons for the visual assessments. Standards, quality control, calibration and intercomparison. Describe national and international measurement standards and best practice for the quality control of observations and calibration and intercomparison of instruments. Upper-air observations. Explain the physical principles and the limitations of instruments used to make upper-air measurements. Coding. Outline how observations are coded and transmitted, and describe the differences between different types of messages (e.g., SYNOP, SHIP, CLIMAT and METAR).Use of observations. Describe the main uses of observations from the WMO Integrated Global Observing System and other sources of information.*

Statistical & Computer

Programming. Use basic computer programming principles, and construct a basic computer programme.

Statistical : Select suitable ways of displaying statistical data and interpret the results, use different measures of central tendency (mean, median and mode) and variation (range, interquartile range and standard deviation), and explain the concepts of sampling, linear regression by least squares, correlation, normal distribution, percentiles and hypothesis testing..

Laboratory and Field Exercises

1. Handling of measuring and recording meteorological instruments for observations, 1st line practice for simple repair and maintenance on site of these instruments.
2. Identification of weather phenomena, direct and estimated measurements of surface weather elements, cloud observations (form, amount and high).
3. Coding and decoding of surface and pilot balloons observations, and their mean monthly values.
4. Entry of observation in the proper registers, table and forms.
5. Plotting surface and upper air diagrams.
6. On Job Training.
7. Written communications. Prepare written communications within specified time limits in a concise, accurate and comprehensible way, including use of word processing and presentation programs.
8. · Oral presentations. Make presentations within stated time limits in which the content and style of delivery accurately conveys information in a way that is understood by the audience.

MANUAL MET. INSTRUMENTS LAB.

9-UPPER AIR TCHNICIAN

Course reference number :	**MTm-09**
Level :	Medium level
Objective :	**To qualify professional observers to serve in the field of upper air measurements**
Qualifications :	**MTj-08 & 2 years Experience as a Met. Technician**
Duration :	**6 weeks.**

SYLLABUS

Introduction

General revision on Math. & Physics, Radiosonde sounding, Electricity and radio, oscillatory circuits, transmitters, receivers, modulation, amplifiers, power supply, wave propagation.

Meteorological Requirements

Radiosonde data for Met. Operations, Relationships between satellite and radiosonde upper air measurements maximum height of radiosonde observations, accuracy requirements, temperature, relative humidity, geopotential heights

Methods of measurements

Constrains on radio design, radio frequency used by radiosondes, radiosondes electronics, power supply, radio transmitter.

Met. Instruments for upper air observations

Sensors, Radiotheodolite wind measurements, GPS wind measurements, methods of calculations, ground station equipment, general features, software for data processing, preparation of radiosondes for flight, Avoidence of outside interference, Surface observations for sounding, data checking and reporting.

Meteorological codes

International and national Met. Codes used to reprt upper air observations.

10-AGROMET. TECHNICIAN

Course reference number : MTm-10

Level : Medium level

Objective : To qualify professional forecasters to serve in the field of agrorneteorology and hydrometeorology.

Qualifications : MTj-08 and 2 years experience in the field of Meteorology.

Duration : **6 weeks.**

SYLLABUS

Introduction

General revision of the main topics of relevance such as radiation and climatology in course No. 100. Importance of weather and climate for agricultural production, national agrometeorological services functions and aims Of the WMO commission for Agricultural Meteorology (CAgM).

Agrometeorological stations

- Agrometeorological factors and instruments.
- Automatic agrometeorological factors.
- Quality control of automatic station data.

Statistical computing

- Introduction in statistics of data analysis, statistical packages that used in data analysis.
- Practical training to the topics using locally row data.

Analyzing of rainfall data

- Methods of Rainfall data analysis.
- Dry and wet seasons (spells).
- Analysis of extreme values.
- Practical training to the topics using locally row data.

Analysis Soil temperature

- Analyses of soil temperature at different depths at dry and grass field using water balance equation.

Hydrological cycle in Agriculture

- Estimates of evaporation and evapotranspiration from climatological data using empirical formula, desertification.

- Practical training to the topics using locally row data.

Biological measurements (phonology)

- Explain stages of crop developments.
- Pests and diseases.
- Crop modeling.

Weather report

- Steps of preparing 10-days agrometeorological weather report.
- Practical training for preparing 10-days agrometeorological weather report.

Laboratory and field exercises

Visiting to agrometeorological station and water requirements department at agriculture research center at GIZA, EGYPT.

11- CLIMATOLOGY TECHNICIAN

Course reference number : **MTm-11**

Level : Medium level

Objective : **To be able to adopt themselves as supervisors on monitoring climate and observed local climatic variability.**

Qualifications : **MTj-08 and 2 years experience in the field of Meteorology.**

Duration : **6 weeks.**

SYLLABUS

Introduction
General revision on mathematics, physics and general meteorology.

General climatology
Definition (climate, climate system, variables, controllers of climate, ……), General circulation, air masses, classification of climatic systems, locale climate, regional climate, and some climatic phenomena (El-niño, seasonal floods & storms,…….etc.), climate services, climate change.

Physical climatology
Radiation (heat) and energy budget, radiative heat transfer (radiative forcing), water budget concept, water balance components.Hydrological cycle

Statistics
Select suitable ways of displaying statistical analysis and interpret the results, use different measures of central tendency (mean, median and mode) and variation (range, interquartile range and standard deviation), and explain the concepts of data sampling, linear regression by least squares, correlation, normal distribution, percentiles and hypothesis testing.

Data processing methods
Effect of network size and density, handling climatological data using computers, operating systems, use of utility programs for statistical methods, code and decode the climate data.

Computer science
Programming languages, algorithms, software used in climatology, archiving, construction of vertical and time cross-sections for various fields.

Laboratory exercises

- Building up a data base
- Extreme value analysis
- Curvilinear relationships
- Validating statistical relationships
- Tests of regression analysis
- Using climatological normals
- …….etc.

Meeting Room

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12-SYNOPTIC TECHNICIAN

Course reference number :	**MTm-12**
Level :	**Medium level**
Objective :	**To be able to adept themselves as appropriate in their future activities as synoptic meteorological technicians.**
Qualifications :	**MTj-08 and 2 years experience in the field of Meteorology.**
Duration :	**6 weeks**

SYLLABUS

Introduction

Mathematics: Functions, limits and derived functions, Integral calculus, partial derivatives and differentials, vector calculus, vector analysis and related operators.
Physics: General thermodynamics (1st and 2nd basic principles), fundamental of elementary mechanics, static and dynamics of a particle, deriving speeds and accelerations.

General Meteorology

General circulation (Surface and altitude), Air masses and Frontal boundaries, formation and developments of disturbances, local phenomena.

Physical Meteorology

***Overview of the atmosphere and terrestrial system*:** Description of the atmospheric environment, recalling basics about electromagnetic radiation, solar and terrestrial radiation, Thermodynamics of the dry and wet atmosphere, Depiction of the vertical structure of the atmosphere on dedicated documents (Tephigram), vertical equilibrium and hydrostatic approximation.

Dynamic Meteorology

Introduction to dynamic meteorology, Basic equation of motion, Affecting forces on the atmosphere, Winds, Thermal wind Divergence and vorticity , physical meaning of mountain wave and its effect.

Statistics

Select suitable ways of displaying statistical data and interpret the results, use different measures of central tendency (mean, median and mode) and variation (range, interquartile range and standard deviation),

and explain the concepts of sampling, linear regression by least squares, correlation, normal distribution, percentiles and hypothesis testing..

Weather analysis and forecasting

Basic principals of weather forecasting, importance of the analysis step, extrapolation, persistence and analogue schemes, methods to be used for forecasts of different ranges, numerical model output and forecast guidance to prepare forecast, global data processing scheme in meteorology, adaptation of general forecasts to lower scale prediction.

Satellite Imagery

Orbits, Different kinds of satellites, Characteristics of meteorological Satellites, Interpretation of satellite images and data.

Computer Science

Programming languages, algorithms and methods used in computer sciences, software development.

Meteorological Telecommunications

The global telecommunication Systems, National meteorological telecommunication networks.

Tropical Meteorology

Energy budget of the earth, general wind circulation, Meteorological equator, Tropical disturbance and hurricanes.

Geography

Map marking, climatology and geography of climates, definitions and classification, climatic area about numerical geographical information systems.

Laboratory exercises

Analysis, Forecasting, Observations, Local climatology, climatology and computer techniques.

13 -Fundamentals of Electronics

Course reference number: Special -13

Level: Special - level

Objective: Qualifying the participant in this course to carry out minor maintenance of electrical systems and all your knowledge of the functions of electronic components to repair its faults

Qualifications : Secondary school certificate (science or math) or MTj-08.

Duration: 2 weeks

SYLLABUS

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The behaviour of passive components in DC and AC

Introduction to passive electronic components provides the participants with both a basic and practical understanding of electricity and electronics. The emphasis is an applications rather than theory. Consequently there is a strong hands-on component to the subject to enable students to gain practical experience. Topics covered in the subject include:

- DC and AC circuits
- Resistor in DC and AC circuits.
- Resistor networks
- CapacitorDC and AC circuits.
- Coil DC and AC circuits.

Transformer

- Basic construction and schematic diagram of a real and Ideal transformer.
- Transformer application
- Pulse transformers
- Transformers for blocked oscillators

Semiconductor electronic components

- Physics of the semiconductors
- Characteristics of semiconductor devices
- Power supply topics include half-wave and full-wave rectifiers, filtering, zener regulation.

Transistors

- Transistor characteristics
- Basic Transistor Circuits
- Voltage divider polarization
- The transistor as a switch
- The transistor as a regulator

Amplification

- Linear amplification of current, voltage and power
- BJT amplifiers: EC, CC and BC configuration
- Power amplifiers in class A
- Power amplifiers in class B
- Power amplifiers in class C

Operational Amplifiers

- Ideal operational amplifier
- Main operational amplifier linear configurations
- Inverting and Non- Inverting configuration
- Differential amplifier
- Integrator
- Comparators, ramp and square wave generators
- Inverting Schmitt trigger

Power electronics components

- Typical problems relevant to power devices
- Power amplifier parameters
- Classification of the output stage
- Harmonic distortion
- Heat dissipation

14-Logic Circuits

Course Reference Number: Special -14

Level : Special - level

Objective: To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of logic circuits.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

Digital Systems

- Combinational Logic
- The theorems of Boolean Algebra
- The Karnaugh's map
- Logic Gates (AND, OR, NAND, NOR, NOT, XOR, XNOR)
- Encoder and Decoder
- Multiplexer and Demultiplexer
- Sequential Logic
- Latches
- Flip-Flops
- Counters
- Shift registers

Memories

- Memory classification
- Terminology and main characteristics
- Elementary memory cells
- Structure and operating principles
- ROM memory
- RAM memory
- Sequential memory

Conversions

- Digital-to-Analogue conversion
- Analogue-to-Digital conversion
- Voltage-to-Frequency conversion

Internet Lab.

15-Automatic Weather Observing Systems (AWOS)

Course Reference Number: Special -15

Level : Special -level

Objective: To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of automatic weather observing systems.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

introduction

Introduction to the function of AWOS

Definitions

- AWOS component
- system definitions

Transducers for Applications in meteorological phenomena sensing

- Transducers for applications in temperature sensing
- Transducers for applications in measurement of linear position and force
- Transducers for applications in measurement of pressure
- Transducers for rotational speed or applications for angular position measurement

16-Microprocessor Operations

Course Reference Number: Special 16

Level: Special - level

Objective: To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of microprocessor operations.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

introduction

Introduction to Microprocessor techniques

Microprocessor Operation

- Microprocessor internal structure
- Addressing modes
- Microprocessor instructions
- Input/Output operations
- Memory operations
- Parallel and series bus
- Parallel interface programming
- Series interface programming
- A/D and D/A programming and interfacing
- Interrupts

17-Digital Signal Communication

Course Reference Number: Special -17

Level : Special –level

Objective: To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of Digital Signal Communication.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

introduction

Introduction to digital signal communication fundamentals.

Digital Signal communication

- Delta modulation and demodulation process.
- PWM and PPM modulation and demodulation process.
- Analog signal impulsive modulation.
- Relationship between sampling frequency and transmission band.
- Sampling Theorem.
- Time multiplexing and TDM signal transmission.
- Problems of receivers synchronization; PAM decoding and demultiplexing.
- Numeric codification of signals.
- Multiplexing for time divisions.
- Numeric signals receiving.
- Numeric/Analogic decodification.
- Time demultiplexing.
- TDM-PCM systems applications.
- Transmission numeric systems behavior in present of attenuation and noise

Digital Signal Transmission

- Study of the ASK, FSK and PSK.
- Study of the base band transmission techniques
- Study of the following types of encoding: RZ, NRZ. Manchester, Bi-phase and Dual binary.

Automatic Met. Stations Lab.

18-Meteorological Instrument Calibration

Course Reference Number: Special -18

Level : Special -level

Objective: To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of Meteorological Instrument Calibration.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

introduction

Introduction to Calibration methods.

Calibration techniques

- Calibration of temperature instruments.
- Calibration of humidity instruments.
- Calibration of pressure instruments.

Met Instrument Calibration lab.

19-Satellite Communication System

Course Reference Number: Special -19

Level : Special -level

Objective: This course covers the principal aspects of a satellite communication system. The topics are covered at an introductory level, with emphasis on qualitative descriptions of the important concepts. The course is intended for participant who is interested in learning about the fundamentals of communication by satellite.

Qualification: Secondary school certificate (science or math) or MTj-08 or equivalent.

Duration: 2 weeks

SYLLABUS

introduction

Introduction to satellite communication system fundamentals.

The operation of receiving and transmitting satellite signals

- Study uplink and downlink satellite signals.
- Study and analyze the digital baseband signals in a satellite link.
- Study the energy dispersal of modulated signal.
- Study the process of telecommunication and telemetry.
- Study various analog and digital modulation parameters.
- Measure the cross polarization discrimination for linear polarized antennas.
- Measure the discrimination of LHCP and RHCP antennas.
- Measure the gain of a given antenna.
- Measure noise parameters in the system and observe its effect.
- Measure the C/N, S/N and threshold in given link.
- Measure the path loss in a satellite link and observe its effect on communication.
- Measure propagation delay in a given satellite link and observe its effect.
- Measure fading of signal in a satellite link and observe its effect.
- Setup active and passive satellite communication link.
- Setup an analog FM – FDM satellite link.
- Transmit and Receive analog and digital modulation parameters.

Logic & Microprocessor Lab.

20-MET. INSTRUMENTSTECHNICIANS

Course Reference Number:		MTm-20
Level	:	Medium level
Objective	:	To improve the ability of the technicians with an excellent educational tool, for the gradual learning of the basic theoretical principles , verification of the practical progress, and testing the practical knowledge of the participants in the field of Met. Instruments Technicians.
Qualification	:	Secondary school certificate (science or math) and MTj-08 or equivalent.
Duration	:	8 weeks

SYLLABUS

introduction

General revision on Math. & Physics, Radiosonde sounding, Electricity and radio, oscillatory circuits, transmitters, receivers, modulation, amplifiers, power supply, wave propagation.

The behaviour of passive components in DC and AC

- DC and AC circuits
- Resistor in DC and AC circuits.
- Resistor networks
- CapacitorDC and AC circuits.
- Coil DC and AC circuits.

Transformer

- Basic construction and schematic diagram of a real and Ideal transformer.
- Transformer application
- Pulse transformers
- Transformers for blocked oscillators

Semiconductor electronic components

- Physics of the semiconductors
- Characteristics of semiconductor devices
- Power supply topics include half-wave and full-wave rectifiers, filtering, zener regulation.

Transistors

- Transistor characteristics
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Amplification

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- Power amplifiers in class B
- Power amplifiers in class C

Operational Amplifiers

- Ideal operational amplifier
- Main operational amplifier linear configurations
- Inverting and Non- Inverting configuration
- Differential amplifier
- Integrator
- Comparators, ramp and square wave generators
- Inverting Schmitt trigger

Power electronics components

- Typical problems relevant to power devices
- Power amplifier parameters

Digital Systems

- Combinational Logic
- The theorems of Boolean Algebra

- The Karnaugh's map
- Logic Gates (AND, OR, NAND, NOR, NOT, XOR, XNOR)
- Encoder and Decoder
- Multiplexer and Demultiplexer
- Sequential Logic
- Latches
- Flip-Flops
- Counters
- Shift registers

Microprocessor Operation

- Microprocessor internal structure
- Addressing modes
- Microprocessor instructions
- Input/Output operations
- Memory operations
- Parallel and series bus
- Parallel interface programming
- Series interface programming
- A/D and D/A programming and interfacing
- Interrupts

Transducers for Applications in meteorological phenomena sensing

- Transducers for applications in temperature sensing
- Transducers for applications in measurement of linear position and force
- Transducers for applications in measurement of pressure
- Transducers for rotational speed or applications for angular position measurement

Instruments maintenance

- Repair and maintenance: electric and electronicpractices, safety and security precautions.
- Installation, repair and field tests for instruments.

Calibration techniques

- Calibration of temperature instruments.
- Calibration of humidity instruments.
- Calibration of pressure instruments.

21-AERONAUTICAL METEOROLOGY FOR PILOT AND NAVIGATOR

Course Reference Number:		**Special -21**
Level	**:**	**Special -level**
Objective	**:**	To be able to use and interpret meteorological codes and Satellite Images and understand the situation.
Qualification	**:**	Secondary school certificate (science or math.)
Duration	**:**	12 weeks

SYLLABUS

Introduction

General revision of the atmospheric elements and structure.

General Met.

Air temperature, atmospheric pressure and altimetry, Surface wind, Humidity, Clouds, Visibility, Fog, Vertical stability of the atmosphere, Air masses and fronts.

Climatology

General circulation of the atmosphere, Climate of the Mediterranean basin and Route climatology.

Meteorological codes

METAR, SPECE, TAF, ARFOR, ROFOR, SIGMET, AIRMET, WARNING, SIGWX chart.

Chart Analysis

Meteorological station and upper air station, analysis and interpretation of surface and upper air weather chart.

Satellite Images Interpretations

Fundamental ideas in Radiation transfer and satellite remote sensing, Types of meteorological satellite, Satellite characteristics, Dissemination of satellite imagery, Basic interpretation of VIS imagery, Basic interpretation of IR imagery, Basic interpretation of WV imagery, Basic

interpretation of 3.7μ imagery, Cloud types, Cloud patterns. The Earth's surface and Atmospheric pollutants.
Waves and fronts, Position of Jet-stream, types of cyclogenesis, ITCZ, cyclones and anticyclones.

hazardous phenomena

Aircraft icing, turbulence, other hazardous phenomena, meteorological aspects of flight planning, definitions, procedures for meteorological services for international air navigation, air traffic services, aerodromes, operation of aircraft, aeronautical information services, aeronautical telecommunications, WMO documentation and ICAO documentation.

Lobe of second flour In RTC/Cairo building

22- Climate Application on Agriculture and Water Resources

Course reference number : **Mm-22**

Level : Medium level

Objective : General revision of the main topics of relevance such as analysis of rainfall and Surface energy exchanges for issue of evaporation report production from any meteorology station and forecast of Nile flood

Qualifications : Mj-08 & 2 years Experience as a forecaster in any Forecasting Center .

Duration : **12 weeks.**

SYLLABUS

Introduction

General revision of the main topics of relevance such as radiation and climatology in course No. 100. Importance of weather and climate for agricultural production, national agrometeorological services functions and aims Of the WMO commission for Agricultural Meteorology (CAgM).

Agrometeorological stations (1 week)

-The importance of agricultural meteorology
- Agrometeorological station (component, exposure,..)
- Instruments,
-Steps of preparing the report of Agrometeorological weather
-Practical training to preparing the report

CLIMATIC STATISTICS (1week)

- Introduction in statistics for data analysis, statistical packages that used in data analysis
-Wind speed analysis
- Analysis of extreme values

Hydrological cycle (1 week)

- Method for analysis of temperature and humidity data, calculating and using water balance equations, including estimates of radiation and evaporation from climatological data through empirical formula,.
- Water sources (Nile flood)
- **Rainfall data analysis**

- Practical training to the topics using locality row data.

Biological measurement (phonology)- 1 week

-Explain stages of crops development
- Pests and diseases
- Crop modeling

Laboratory and field exercises

- Visiting to Agrometeorological station and Water Requirements Department at Agriculture Research Center at GIZA, Egypt.

23- INSTRUMENTAL SPECIALIST

Course reference number : MTm-23

Level : Medium level

Objective : Education, training and rehabilitation of trainees to work in the maintenance and repair cost monitoring systems As well as the development of technical specifications of the different systems

Qualifications : B.Sc. physics, Electronic , Communication engineer or physic sciences .

Duration : **32 weeks.**

SYLLABUS

Electronic

-General introduction to electronics to reached by the trainer to maintain the instrument

Theoretical

-Basics of electricity

-Electric circuits

-Element of electronics

-Electronic and logic circuits

Practical

-Maintenance of electronic device

Communication

Satellite

Introduction

-Study general Introduction to satellite communication systems.

Theoretical

- Basics of satellite communication systems.
-Types of satellite communication systems.
-Basics components of operational satellite communication systems.
-Earth station of satellite communication System.
-Space station of -satellite communication System.

Practical

-Lab
-MSG, HRPT, ODP, METOFACTORY which used in EMA methodology.

Fundamental networks

Network

-Basic network concepts.
-Network protocols & standers.
-Network components.
-TCP/IP fundamentals.
-Sub netting & routing
-TCP/IP utilities.
-Wireless networking.
-Implementing a network.
-Maintaining & supporting a network.
-Network security.
-Troubleshooting the network.

Practical

-Labs
-GTS, WIS which used in meteorology.

IT

Practical applications on the network maintenance

Programming and Database

My SQL

Instruments

Introduction

-General introduction
-Signal characteristic
-Uncertainty analysis, error propagation, uncertainty quantification
-Analog to digital, digital to analog conversion
-Data acquisition systems

Surface instruments

Wind speed
Wind directions
Temperature
Relative humidity
Rain
RVR
Pressure

Upper air radio sound and ground stations

Radio theodolite
GPS
Radar

Research instrument measurements

Ozone

Surface
Global

Radiation

Pollution

Calibration labs

International Relations

ICAO

WMO

ITU

Market update

To identify and comparison between companies and manufactures which specialist in meteorological instruments and satellite ground stations

Exam

24-Communication Networks

Course Reference Number: MTm-24

Level : **Medium- level**

Objective : To qualify the trainer to serve In metrology communication Systems (working & maintenance).

Qualification : B.Sc. Electronic or Communication engineer or Equivalent or 3 years in communication engineering.

Duration : 6 Weeks

SYLLABUS

Introduction

Telecommunication types which used in metrology systems. Network systems and topology

Communication :

- Communication Milestones.
- Major Types of communication systems.
- Analog and digital communication systems.
- Data transmitted.
- The current industrial standard communication Sys.

Network :

- Basic network concepts.
- Network protocols & standers.
- Network components.
- TCP/IP fundamentals.
- Sub netting & routing
- TCP/IP utilities.
- Wireless networking.
- Implementing a network.
- Maintaining & supporting a network.
- Network security.

- **Troubleshooting the network.**

Practical :

-Labs

-GTS, WIS which used in metrology

25-Advanced telecommunication system in metrology

Course Reference Number: Special -25

Level : Special -level

Objective :To qualify the trainer to serve In metrology communication Systems (working maintenance).

Qualification :B.Sc. Electronic or Communication engineer or Equivalent or 3 years in communication engineering.

Duration : 2 Weeks

SYLLABUS

Introduction

Telecommunication types which used in metrology systems. Network systems and topology

Communication :

- Communication Milestones.
- Major Types of communication systems.
- Analog and digital communication systems.
- Data transmitted.
- The current industrial standard communication Sys.

Network :

- Basic network concepts.
- Network protocols & standers.
- Network components.
- TCP/IP fundamentals.
- Wireless networking.
- Maintaining & supporting a network.
- Troubleshooting the network.

Practical :

-Labs
-GTS, WIS which used in metrology.