



MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.

Tel: +254(0) 799 529 958, +254(0) 799 529 959, +254 (0)712 524 293

Website: www.must.ac.ke Email: info@mucst.ac.ke

UNIVERSITY EXAMINATIONS 2022/2023

FIRST YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN PHYSICS AND MASTER OF SCIENCE IN CHEMISTRY

SPH 7158: EXTRAGALACTIC ASTRONOMY

DATE: AUGUST 2023

TIME: 3 HOURS

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

- a) Differentiate between normal and active galaxies? (3 Marks)
- b) Briefly describe Active Galactic Nuclei (10 Marks)
- c) Why do stars twinkle but planets don't? (7 Marks)
- d) Describe the Local Group of galaxies. (10 Marks)

QUESTION TWO (20 MARKS)

A traditional method of measuring deceleration parameter q_0 dates back to Hubble and uses the brightness of elliptical galaxies as a standard candle and lookback for curvature in the Hubble diagram:



- a) Show that for a $\Lambda = 0$ universe (with only matter component), the distance modulus is given by $m_{mod} = M_{bol} + 25 + 5 \log_{10} \left(\frac{cz}{100 \text{ km/s}} \right) + 1.086 \left(1 - \frac{\Omega_m}{2} \right) z + \dots$ where Ω_m is the matter density parameter at present time.
- b) Suppose that all stars in an elliptical galaxy were born at the same time with Salpeter initial mass function and has been passively evolved. Using the approximated main sequence scattering relation $L \propto M^{3.5}$ and $G = 6$ at present time, estimate the bias in M_{bol} caused by ignoring the luminosity evolution as a function of the galaxy redshift z (obtain the result to linear z)
- c) How is the bias translated into the bias in measuring Ω_m ?

QUESTION THREE (20 MARKS)

Describe the following galaxy evolution stages:

- a) Galaxy formation (6 Marks)
- b) Galactic mergers (6 Marks)
- c) Galactic death (8 Marks)

QUESTION FOUR (20 MARKS)

Describe the following galaxies:

- a) Elliptical (5 Marks)
- b) Irregular (5 Marks)
- c) Spiral (5 Marks)
- d) Barred spiral (5 Marks)

