Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

(a) Bellatrix and Betelgeuse are stars in the constellation of Orion. Some of their properties are summarised below.

	Bellatrix	**Betelgeuse**
absolute magnitude	–6.0	–2.7
apparent magnitude	0.4	1.6
black-body temperature / K	22 000	2 400

(i) Explain what is meant by absolute magnitude.

_____

_____

_____

(1)

(ii) Which of the two stars is closer to the Earth? Explain your answer.

_____

_____

_____

(1)

(b) (i) Calculate the wavelength of the peak intensity in the black-body radiation curve of Bellatrix.

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answer = _____ m

(2)

(ii) Sketch the black-body radiation curve for Bellatrix. Label the wavelength axis with a suitable scale.



(3)

(c) Detailed analysis of the light from both stars reveals the presence of prominent absorption lines in the spectra.

(i) To which spectral class does Bellatrix belong?

_____

(1)

(ii) Prominent features in the Bellatrix spectrum are the Balmer absorption lines due to hydrogen. State the other element responsible for the prominent absorption lines in the spectrum of Bellatrix.

_____

(1)

(iii) Why does the spectrum of Betelgeuse not contain prominent Hydrogen Balmer absorption lines?

_____

_____

_____

(1)

(Total 10 marks)

Q2.

(a) Draw the ray diagram for a Cassegrain telescope. Your diagram should show the paths of two rays, initially parallel to the principal axis, as far as the eyepiece.

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(2)

(b) A telescope design very similar to the Cassegrain was first proposed by James Gregory in 1663. His telescope design was also the first to include a parabolic primary reflector.

(i) The use of a parabolic reflector overcomes the problem of *spherical aberration.* Draw a ray diagram to show how spherical aberration is caused by a concave spherical mirror.

(1)

(ii) The first telescope constructed to this design had a primary mirror of diameter 0.15 m. Calculate the minimum angular separation which could be resolved by this telescope when observing point sources of light of wavelength 630 nm. State an appropriate unit.

answer = _____

(2)

(iii) The astronomer Edmund Halley claimed to have used this telescope to observe the Cassini division, a dark band in the rings of Saturn. Calculate the angle subtended by the width of this band at the Earth, and comment on whether Halley's claim is likely to be valid.

width of Cassini division = 4.8×10^3km

distance from Earth to Saturn = 1.4×10^9km

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answer = _____

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

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