1. (a) A radio telescope with a reflecting dish of diameter d receives signals from a radio source. Show that the power of the signal received by the telescope is proportional to d^2.

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(2)

(b) A radio telescope has a dish of radius 60 m and detects a signal of power 7.5×10^{-16} W from a radio source. If the distance of the source from the telescope is 2.5×10^{28} m, calculate the power of the source. Assume that the energy is radiated uniformly in all directions and that there is no absorption of energy.

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(3)
(Total 5 marks)

2. (a) The original dish design of the Lovell Radio Telescope at Jodrell Bank used a 50 mm open wire mesh. Estimate the minimum wavelength detectable using this design.

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(1)

(b) Before completion, the mesh was replaced by a solid metal surface of diameter 76 m capable of detecting radio signals as small as 60 mm wavelength. Calculate the resolving power of the telescope when detecting radiation of this wavelength.

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(2)

(c) The Jodrell Bank Observatory also has a 13 m diameter radio telescope. State **two** advantages the telescope described in part (b) has over this smaller telescope when detecting radio waves of the same wavelength. Support each answer with a calculation.

advantage 1:

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advantage 2:

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(4)

(Total 7 marks)

3. Modern astronomy relies on the analysis of radiation from many different parts of the electromagnetic spectrum. Compare the main features of telescopes used to detect radio waves with those of optical reflecting telescopes. Explain the differences in their resolving and collecting powers.

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(Total 6 marks)