MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
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IV SEMESTER B.TECH. (OPEN ELECTIVE)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: FUNDAMENTALS OF ASTRONOMY & ASTROPHYSICS [PHY3281]

REVISED CREDIT SYSTEM

TIME: 3 HOURS   MAX. MARKS: 50

<u>Note:</u> *Missing data may be suitably assumed*

$G = 6.67 \times 10^{-11}$ m^3/kg/s^2	$M_\odot = 2 \times 10^{30}$ kg
$R_\odot = 7 \times 10^8$ m	$L_\odot = 3.9 \times 10^{26}$ W
$1 AU = 1.5 \times 10^{11}$ m	$c = 3 \times 10^8$ m/s
$m_p = 1.67 \times 10^{-27}$ kg	$m_e = 9.1 \times 10^{-31}$ kg
$e = 1.602 \times 10^{-19}$ C	1 Jy $= 10^{-26}$ Wm^{-2}Hz^{-1}

1A.   What is absolute magnitude? Mention the significance of defining star brightness in absolute magnitude. [2M]

1B.   Define parsec (pc) and show that 1 pc = 3.26 light years. [3M]

1C.   The apparent magnitude of a star is observed to be +3.3 and its parallax is 0.025". Find the absolute magnitude of the star and compare the luminosity of the star with that of Sun. [5M]

2A.   What are variable stars? Briefly explain. [2M]

2B.   Estimate the lifetime of a $10M_\odot$ star on the main sequence to give off energy stored from gravitational collapse. [3M]

2C.   Derive the expression for gravitational potential energy of a sphere. [5M]

3A.   Compute the rest energy of a proton and express the result in MeV. [2M]

3B.   Derive the equation of hydrostatic equilibrium. [3M]

3C.   Briefly explain evolution off the main sequence of stars. [5M]

4A.   What is gravitational red shift (GRS)? Derive approximate expression for GRS. [2M]

4B.   Obtain the relativistic expression for kinetic energy. [3M]

4C. An astronaut must journey to a distant planet, which is 200 light-years from Earth. What speed will be necessary if the astronaut wishes to age only 10 years during the round trip? [5M]

5A. How large a collecting area would you need to collect 1 W from a 1 Jy source over a bandwidth of 1 GHz? [2M]

5B. Two radio sources in the Orion Nebula are 500 pc from us and are separated by 0.1 pc. How large a telescope would you need to distinguish the sources at a wavelength of 21 cm? [3M]

5C. What are Jeans Length and Jeans Mass? Derive the expression for Jeans Length and Jeans Mass. [5M]

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