Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (OPEN ELECTIVE)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: FUNDAMENTALS OF ASTRONOMY & ASTROPHYSICS [PHY3281]

REVISED CREDIT SYSTEM

TIME: 3 HOURS MAX. MARKS: 50

Note: Missing data may be suitably assumed

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

1A. What is color index? How it is related to surface temperature of stars? [2M]

1B. What is H – R diagram? Explain its significance. [3M]

1C. A star at 4 pc has an apparent magnitude 2. What is its absolute magnitude? Also, find the luminosity of the star. Given: Apparent magnitude of Sun is - 26.73 [5M]

2A. What is solar neutrino problem? Explain. [2M]

2B. Prove that gravitational potential energy is not the source of energy in Sun. Given: Age of Earth is 4 billion years. [3M]

2C. Derive approximate expression for electron degeneracy pressure. [5M]

3A. If fusion is the source of energy, what is the rate at which Sun is converting mass into energy? [2M]

3B. Explain the process of formation of heavier nuclei via neutron capture. [3M]

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

4A. It is believed that pulsars are rotating neutron stars. On what observational bases astronomers have been able to derive this conclusion? [2M]

4B. Obtain the relativistic expression for kinetic energy and show that in non-relativistic system, it reduces to $mv^2/2$. [3M]

4C. Consider a rotating neutron star with a mass $M = 2\ M_\odot$, and a radius $R = 15$ km, a period $P = 0.1$ s, and a rate of change of the period $dP/dt = 3 \times 10^{-6}$ s/yr. Find (a) the kinetic energy, (b) the rate at which the kinetic energy is decreasing, and (c) the lifetime of the pulsar if it loses energy at this rate. [5M]

5A. Compare the light-gathering power of the naked eye, with a pupil diameter of 5 mm, to that of a 1 m diameter optical telescope and express your answer in magnitude difference. [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. Based on Newtonian gravitation, explain the concept of open and closed universe. [5M]

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