Mid Semester Examination II – Monsoon 2017 IIIT-Hyderabad

	100	Subject Sei Jagge	
Fu	ıll Ma	arks: 35 Subject: Science I (ISC201)	
ARRIVA		Use of non-programmable scientific calculators is allowed	
71	(a)		
		Compare space quantization diagrams of the Bohr-Sommerfield orbits with the azimuthal quantum number $k = 3$ and $k = 4$. (Note: You need to specify the respective orientation	
	(b)		3M
	(c)	Discuss the characteristics of a well-behaved wavefunction.	3M
1		went-behaved wavefunction.	2M
2	(a)	Obtain the Schröedinger equation from the plane wave equation.	
	(b)	Does the curvature of a way of	M
	i i	Does the curvature of a wavefuction depend on the sign of the wavefunction and relative using schematic diagrams. 3. 2. 3. 3. 4. 4. 4. 5. 6. 7. 8. 8. 8. 8. 8. 8. 8. 8. 8	И
	(c)	Construct operators for the momentum and kinetic energy of a great	
3.	(a)	Discuss the formation of a chemical bond between two hydrogen atoms to form a H ₂	
	(6)	molecule in terms of the symmetry and antisymmetry wavefunctions. Consider a quantum system with two electrons.	
		allowed states for these electrons, write possible wavefunctions of the system. Among the possible wavefunctions, identify the wavefunction that obeys the Pauli's exclusion 2M principle.	I
	(c)	The azimuthal wave function for the hydrogen atom is $\psi(\phi) = Ae^{im_i\phi}$. Show that the value	
	~	of normalization constant A is $\frac{1}{\sqrt{2\pi}}$ over all angles 0 to 2π .	M.
-		$\sqrt{2\pi}$	
	1		
4	(a)	Find the expectation values of the operators p _x and p _x ² for a quantum particle with a	
		wavefunction $\sqrt{\frac{2}{L}} \sin \frac{\pi x}{L}$ in the range 0 to L.	3M
	(b)	Write a short note on Born-Oppenheimer approximation.	2M
	(c)	Write the Hamiltonian for a hydrogen molecule. 9	2M
	1		
5	(a)	Show that for a given orthonormal function, the expectation value of the Hamiltonian is	
SCHE!		of cedan to the state B	3M
	(b)	Describe the procedure of obtaining a trail wavefunction using the molecular orbital	4M
		theory.	