

**B.Sc. Semester I (Honours) Examination, 2019****ELECTRONICS****Course ID : 11712****Course Code : SHELC-102C-2(T)****Course Title : Mathematics Foundation for Electronics****Time: 1 Hour 15 Minutes****Full Marks: 25***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer *any three* of the following: 1×3=3
- (a) What do you mean by differential equation?
- (b) Give one example of partial differential equation of 2nd order.
- (c) What is 'order' and 'degree' of a differential equation?
- (d) What is a 'singular' point?
- (e) What is recurrence relation?
- (f) Give the definition of Gamma function ( $\Gamma$ ).
2. Answer *any three* of the following: 2×3=6
- (a) What is the 'ordinary' point? 2
- (b) What is the origin of 'indicial' equation? 2
- (c) What is the relation between Beta and Gamma functions?  
 Show that:  $\Gamma(n + 1) = n\Gamma(n) = n!$  1+1=2
- (d)  $\beta(m + 1, n) = \frac{m}{m+n} \cdot \beta(m, n)$  — Prove this from the definition. 2
- (e) What is an analytic function? 2
- (f) Give one example of row matrix and column matrix. 1+1=2
3. Answer *any two* of the following: 5×2=10
- (a) Solve one dimensional heat flow equation:  
 $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$  by separation of variables method.
- (b) Show that the polar forms of Cauchy-Riemann (C-R) equation are  
 $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{\partial u}{\partial \theta}.$

- (c) Construct the recurrence relation by solving given differential equation, by power series method:

$$(1 - x^2) \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = 0$$

- (d) Find the eigenvalues and eigenvectors of the matrix  $\begin{pmatrix} 5 & 4 \\ 1 & 2 \end{pmatrix}$ .

Or,

Obtain the indicial equation for the given Bessel's equation of order 'n'.

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$

4. Answer *any one* of the following questions: 6×1=6

- (a) Find the value of  $\Gamma\left(\frac{1}{2}\right)$  and hence plot the graph of Gamma function for  $n = -\infty$  to  $+\infty$  (i.e. for whole range.) 3+3=6

- (b) What is Argand's diagram? Draw the Argand diagram for a complex number. State Residue Theorem. What are the various methods of calculation of Residue? (1+2)+(1+2)=6

- (c) Find the diagonal form of matrix

$$A = \begin{pmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{pmatrix} \quad 6$$

Or,

Evaluate the given integral using residue theorem

$$I = \int_C \frac{4-3z}{z(z-1)(z-2)} dz$$

where  $C$  is a circle with  $|Z| = 3/2$ . 6

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