# SANJAY GHODAWAT UNIVERSITY, KOLHAPUR

2020-21

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EXM/P/09/00

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|---|---|---|
| **Year and Program: T.Y.B.Sc. (2020-21)** | **SCHOOL OF SCIENCE** | **Department : Physics** |
| **Course Code: PHS 305** | **Course Title: Physics VII Mathematical Physics** | **Semester : V** |
| **Day :<br>Date : December 2020** | **End Semester Examinations** | **Time : 2 Hrs.<br>Max Marks : 50** |

**Question Paper**

**Instructions**: 1) All Questions are compulsory.
2) Scientific calculator is allowed for numerical calculation.

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| | | Marks | Bloom's Level | CO |
|---|---|---|---|---|
| **Q.1** | **Answer the following (any Two)–** | | | |
| a) | Prove that following relations of differential operators<br>i) $E = 1 + \Delta$<br>ii) $E^{-1} = 1 - \nabla$<br>iii) $E\,\nabla = \nabla\,E = \Delta$<br>iv) $(1+\Delta)(1-\nabla) = 1$. | 8 | L1 | 2 |
| b) | Find the rank of following matrix by reducing it to normal form<br>$A=\begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{bmatrix}$. | 8 | L2 | 1 |
| c) | Prove that $\beta(m,n) = \dfrac{\lceil m \;\lceil n}{\lceil m+1}$ and $\left\lceil \dfrac{1}{2} = \lceil \pi \right.$. | 8 | L1 | 3 |

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| **Q.2** | **Answer the following (any two) –** | | | |
| a) | Evaluate $\int_0^1 \dfrac{dx}{1+x^2}$ using Trapezoidal, Simpson's $\dfrac{1}{3}$, Simpson's $\dfrac{3}{8}$ rule, also find the value of $\pi$. | 8 | L3 | 2 |
| b) | Using Runge-Kutta fourth order method, solve $\dfrac{dy}{dx} = \dfrac{y^2 - x^2}{y^2 + x^2}$ with $y(0)=1$ at $x=0.2$ & $x=0.4$. | 8 | L2 | 2 |

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|---|---|---|---|---|
| c) | Solve the equation $xy'' + y' + xy = 0$ in series by using Frobenius method. | 8 | L2 | 3 |

**Q.3** **Answer the following (any two) –**

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|---|---|---|---|---|
| a) | Find the Fourier series for the function $f(x) = 2x^2 - x^2$ for the interval $0 < x < 3$. | 9 | L3 | 4 |
| b) | Using Taylor's series expansion method, find the value $y(x)$ at point $x = 0.1$ & $x = 0.2$ for ordinary differential equation $\frac{dy}{dx} = x^2 y - 1$, while $y(0) = 1$. | 9 | L3 | 2 |
| c) | Find the Fourier series for the function $f(x) = \begin{cases} -\pi & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$ further find the series sum of the terms for $x = 0$ & $x = x + \pi$ | 9 | L2 | 4 |

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