

M.Sc.(Mathematics) (NEP Pattern) - Semester-III  
**03NEPMATH04.3 - General Relativity**

P. Pages : 2

Time : Three Hours



**GUG/W/24/16018**

Max. Marks : 80

- Notes : 1. Solve all five questions.  
2. Each question carries equal marks.

**UNIT – I**

1. a) Show that Christoffel symbols of second kind are not tensor. 8  
b) Show that, the covariant derivative of  $g_{mn}, g^{mn}$  and  $\delta_n^m$  vanish. 8

**OR**

- c) State and prove the Bianchi Identity. 8  
d) Show that in q-space. 8  
$$\frac{R_{11}}{g_{11}} = \frac{R_{22}}{g_{22}} = \frac{R_{12}}{g_{12}} = -\frac{R_{1212}}{g}$$

**UNIT – II**

2. a) Discuss the principle of equivalence. 8  
b) Show that Newton's theory of gravitation can be regarded as first approximation of general theory of relativity. 8

**OR**

- c) Obtain the energy momentum tensor in the Galilean coordinate system. 8  
d) Derive the relation between Newton's gravitation potential V and  $g_{44}$ . 8

**UNIT – III**

3. a) Derive Schwarzschild exterior solution. 8  
b) Discuss on advance perihelion of mercury. 8

**OR**

- c) Find the expression of bending of light rays in the gravitational fields of sun. 8  
d) Find the expression of bending of light rays in the gravitational field of sun. 8

## UNIT – IV

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|-----------|----|--|---|
| 4.        | a) | Derive Weyl solution.  | 8 |
|           | b) | Derive the linearized field equation.  | 8 |
| <b>OR</b> |    |  |   |
|           | c) | To derive the static spherically symmetric solutions of linearized field equation. | 8 |
|           | d) | Derive the line element for the interior Schwarzschild solution.                   | 8 |
| 5.        | a) | Show that<br>$g_{mn,r} = [mr, n] + [nr, m]$ .                                      | 4 |
|           | b) | Explain Mach principle.  | 4 |
|           | c) | Discuss Schwarzschild singularity.   | 4 |
|           | d) | Discuss Associated Weyl solution.  | 4 |

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