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Total No. of Questions : 11 ]

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# ASP-654

M.A./M.Sc. (Final) Examination, 2021

## MATHEMATICS

Paper - Opt-XII

(Relativity and Transform Calculus)

(For Due Only)

Time : 1½ Hours ]

[ Maximum Marks : 100

### Section-A

(Marks : 2 × 10 = 20)

**Note :-** Answer all *ten* questions (Answer limit 50 words). Each question carries 2 marks.

(खण्ड-अ)

(अंक : 2 × 10 = 20)

**नोट :-** सभी दस प्रश्नों के उत्तर दीजिए (उत्तर-सीमा 50 शब्द)। प्रत्येक प्रश्न 2 अंक का है।

### Section-B

(Marks : 4 × 5 = 20)

**Note :-** Answer all *five* questions. Each question has internal choice (Answer limit 200 words). Each question carries 4 marks.

(खण्ड-ब)

(अंक : 4 × 5 = 20)

**नोट :-** सभी पाँच प्रश्नों के उत्तर दीजिए। प्रत्येक प्रश्न में विकल्प का चयन कीजिए (उत्तर-सीमा 200 शब्द)। प्रत्येक प्रश्न 4 अंक का है।

### Section-C

(Marks : 20 × 3 = 60)

**Note :-** Answer any *three* questions out of five (Answer limit 500 words). Each question carries 20 marks.

(खण्ड-स)

(अंक : 20 × 3 = 60)

**नोट :-** पाँच में से किन्हीं तीन प्रश्नों के उत्तर दीजिए (उत्तर-सीमा 500 शब्द)। प्रत्येक प्रश्न 20 अंक का है।

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ASP-654 P.T.O.

**Section–A**

1. (i) Define Postulates of Relativity.
- (ii) Define Parallel Velocity.
- (iii) Define Relativistic Hamiltonian.
- (iv) Write Geodesic Principle.
- (v) Write Kepler Law.
- (vi) State Birkhoff's Theorem.
- (vii) Define Fourier Transform.
- (viii) Define Cosine Complex Transform.
- (ix) Define Hankel Transform.
- (x) Define Parseval Identity for Hankel Transform.

**Section–B**

2. Discuss Michelson-Morley experiment.

*Or*

Derive special Lorentz transformation equation.

3. Discuss principle of equivalence and general covariance.

*Or*

Discuss Newtonian approximation of relativistic equation of motion.

4. State and prove Birkhoff's theorem.

*Or*

Discuss Gravitation red shift of Spectral lines.

5. Derive inversion formula for Fourier sine transform.

*Or*

Find the Fourier transform of :

$$f(x) = \begin{cases} 1-x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$$

6. Find the Hankel transform of  $x^{-2}e^{-x}$ , taking  $xJ_1(Px)$  as the Kernel.

*Or*

Find  $M\{\sin x\}$ .

**Section–C**

7. Discuss transformation equations for components of velocity, acceleration of a particle.
8. Discuss Einstein's field equations and its Newtonian approximation.
9. Explain Schwarzschild external solution and its isotropic form.
10. Find the sine and cosine transform of :

$$\frac{e^{ax} + e^{-ax}}{e^{\pi x} - e^{-\pi x}}$$

11. Find Hankel transform of  $\frac{d^2 f}{du^2} + \frac{1}{x} \frac{df}{dx}$ , where P is a root of the equation :

$$PJ_0^1(P) + hJ_0(P) = 0$$