PU Ph D Mathematics

Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.Error! Not a valid embedded object.

1 of 100

189 PU_2015_118

Let *f*: *R* → *R* be a continuous function. Suppose that there exists a sequence $\{p_n\}_{n=1}^{\infty}$ of polynomials converging to *f* uniformly on *R* then:-

Error! Not a valid embedded object.*f* must be a polynomial
Error! Not a valid embedded object.*f* must be uniformly continuous on *R*
Error! Not a valid embedded object.*f* must be bounded
Error! Not a valid embedded object.*f* must be a constant function

2 of 100

135 PU_2015_118

At *z* = 0, the function $f(z) = z^2\bar{z}$:-

Error! Not a valid embedded object. Is differentiable
Error! Not a valid embedded object. Is analytic
Error! Not a valid embedded object. Satisfies Cauchy-Reimann equation but is not differentiable
Error! Not a valid embedded object. Does not satisfy Cauchy Reimann equation

3 of 100

112 PU_2015_118

If the Lagrangian of the harmonic oscillator is $L = \frac{1}{2m}p^2 - \frac{1}{2}m\omega^2 q^2$ and $F(q,Q) = \frac{m}{2}\omega q^2 \cot Q$ be the generating function of the canonical transformation then the Hamiltonian in (*P*, *Q*) is:-

Error! Not a valid embedded object.*Q* sin *P*
Error! Not a valid embedded object.*P* sin *Q*
Error! Not a valid embedded object.ω *Q*
Error! Not a valid embedded object.ω *P*

4 of 100

188 PU_2015_118

The rank of the matrix *A* = $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \\ 13 & 14 & 15 & 16 \end{bmatrix}$ is:-

Error! Not a valid embedded object.2
Error! Not a valid embedded object.4
Error! Not a valid embedded object.3
Error! Not a valid embedded object.1

5 of 100

185 PU_2015_118

Let R be a commutative ring and let characteristic of R be n. If n is a prime number then:-

Error! Not a valid embedded object.R need not be an integral domain
Error! Not a valid embedded object.R is a direct product of two fields
Error! Not a valid embedded object.R is a field
Error! Not a valid embedded object.R is an integral domain but it need not be a field

6 of 100
137 PU_2015_118

The function defined by $f(\mathrm{x}) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ 0 & \text{if } x \text{ is irrational} \end{cases}$ is:-

Error! Not a valid embedded object. Unbounded
Error! Not a valid embedded object. Riemann integrable
Error! Not a valid embedded object. Continuous function
Error! Not a valid embedded object. Nowhere continuous

7 of 100
197 PU_2015_118

Which of the following pair of functions is not a linearly independent pair of solutions of $y'' + 9y = 0$?

Error! Not a valid embedded object. $\sin 3x,\ \sin 3x \cos 3x$

Error! Not a valid embedded object. $\sin 3x + \cos 3x,\ 4\cos^3 x - 3\cos x$

Error! Not a valid embedded object. $\sin 3x + \cos 3x,\ 3\sin x - 4\sin^3 x$

Error! Not a valid embedded object. $\sin 3x, \sin 3x - \cos 3x$

8 of 100
134 PU_2015_118

The value of $\int_{|z|=1} \frac{\sin z}{z^2 e^z} dz$:-

Error! Not a valid embedded object.$\pi i/2$

- 0
- πi
- $2\pi i$

9 of 100
191 PU_2015_118

The value of $\int_2^3 \frac{dx}{1+2x}$ correct up to three decimal places by Simpson's 1/3rd rule is:-

- 0.148
- 0.138
- 0.166
- 0.158

10 of 100
196 PU_2015_118
Which of the following is elliptic?

- $u_{xx} + 2u_{xy} + 4u_{yy} = 0$
- $u_{xx} + 2u_{xy} - 4u_{yy} = 0$
- $u_{xx} - 2u_{xy} - 4u_{yy} = 0$
- $2u_{xx} + 2u_{xy} - 4u_{yy} = 0$

11 of 100

192 PU_2015_118

Three wheels make 60, 36 and 24 revolutions per minute respectively. There is a red spot on the rim of all the three wheels. If the red spot was at the bottom most point when they all started, after how much time would they be at the bottom most point again?

- 5 seconds
- 12 seconds
- 12 minutes
- 5 minutes

12 of 100

132 PU_2015_118

What is the image of the set $\{z \in C : z = x + iy, x \geq o; y \geq o\}$ under the mapping $z \to z^2$?

- $\{z = x + iy, x \geq o\}$
- $\{z = x + iy: x^2 + y^2 = 1\}$
- $\{z = x + iy: x^2 + y^2 \leq 1\}$
- $\{z = x + iy: \ y \geq o\}$

13 of 100

203 PU_2015_118

Which of the following statements is true?

- If the Lebesgue outer measure of *A* is positive, then *A* must contain an interval of positive length
- If the Lebesgue outer measure of *A* is zero, then *A* is nowhere dense in *R*
- If *A* is nowhere dense in [0,1], then the Lebesgue outer measure of *A* is zero
- The Lebesgue outer measure of any non empty open set in *R* is positive

14 of 100

119 PU_2015_118

The topology on the real line R generated by the class of all closed intervals with length *l* is:-

- Indiscrete
- Neither discrete nor Hausdorff
- Standard topology
- Discrete

15 of 100

115 PU_2015_118

If $J(\bar{x}, t)$ is the Jacobian of the fluid flow map of an incompressible fluid, then:-

- $J(\bar{x}, t) \equiv 1$
- $J(\bar{x}, t) \equiv 0$

- $J(\bar{x}, t) < 0$
- $J(\bar{x}, t) > 1$

16 of 100

165 PU_2015_118

Which one is the correct statement?

- Irreducible polynomials over finite fields have distinct roots
- All the polynomials over a field of characteristic zero have distinct roots
- All polynomial with zero derivative over afield of characteristic p have distinct roots
- Irreducible polynomials over a field of characteristic p have distinct roots

17 of 100

117 PU_2015_118

A connected graph G with at least two vertices contains:-

- At most two vertices that are not cut vertices
- At least three vertices that are not cut vertices
- At least two vertices that are not cut vertices
- At most three vertices that are not cut vertices

18 of 100

150 PU_2015_118

Let G be a group of order np^k and gcd (n,p) = 1. Then G contains a subgroup H of order p^r only if:-

- G is abelian and r = k
- r = k
- r less than or equal to k
- G is abelian and r less than or equal to k

19 of 100

198 PU_2015_118

Which of the following is not an integrating factor of $xdy - ydx = 0$?

- $\frac{1}{xy}$
- $\frac{x}{y}$
- $\frac{1}{x^2+y^2}$
- $\frac{1}{x^2}$

20 of 100

194 PU_2015_118

Pick the region in which the PDE $yU_{xx} + 2xy\,U_{xy} + xU_{yy} = U_x + U_y$ is hyperbolic.

- $xy > 1$
- $xy \neq 1$
- $xy \neq 0$
- $xy > 0$

21 of 100

110 PU_2015_118

The involute of a circular helix is a plane curve then:-

- $\kappa^2 = \tau$
- $\tau = 0$
- $\kappa = \tau$
- $\kappa = 0$

22 of 100

120 PU_2015_118

Let $S = \left\{\frac{1}{n} : n \in N\right\} \cup \{0\}$ and $T = \left\{n + \frac{1}{n} : n \in N\right\}$ be the subsets of the metric space R with the usual metric. Then:-

- S is complete but not T
- Both S and T are complete
- T is complete but not S
- Neither T nor S is complete

23 of 100

186 PU_2015_118

Which of the following statements is true?

- The diagonal elements of a diagonal matrix are zero
- The diagonal elements of a skew symmetric matrix are zero
- The diagonal elements of a symmetric matrix are zero
- The diagonal elements of a triangular matrix are zero

24 of 100

136 PU_2015_118

Which of the following function is uniformly continuous on (0,1)?

- $\frac{1}{x}$
- $\frac{\sin(x^2)}{\sin^2(x)}$

- $e^{\frac{1}{x}}$
- $\sin\left(\frac{1}{x}\right)$

25 of 100

164 PU_2015_118

Let K be a field extension of F and an element a in K satisfies the polynomial of degree n over F. Then:-

- [F(a) :F] = n
- n divides [F(a) :F]
- [F(a) :F] > n
- [F(a) :F] ≤ n but need not equal to n

26 of 100

113 PU_2015_118

If the eigen values are $s \pm \sqrt{s^2 - d}$, where $s = -\frac{1}{2}\alpha, d = \beta$, then $\beta < 0$ is:-

- Stable node
- Stable spiral
- Saddle
- Unstable spiral

27 of 100

111 PU_2015_118

A particle glidding on the rough inner surface of a rotation paraboloid belongs to a class of system:-

- Scleronomic, holonomic and conservative
- Nonholonomic
- Rheonomic
- Scleronomic, holonomic but not conservative

28 of 100

163 PU_2015_118

Let K be an extension of F.

- For any element a in K every element of F(a) algebraic over F
- For any element a in K, F(a) is a finite extension of F
- If an element a in K satisfies a polynomial over F, then every element of F(a) is algebraic over F
- Then every element of K is algebraic over F

29 of 100

195 PU_2015_118

Which of the following concerning the solution of the Neumann problem for Laplace's equation, on a smooth bounded domain, is true?

- Solution is unique upto a multiplicative constant
- No conclusion can be drawn about uniqueness
- Solution is unique
- Solution is unique upto an additive constant

30 of 100

138 PU_2015_118

The sequence of functions $f_n(x) = \dfrac{1}{1+(x-n)^2}$ on $(-\infty, 0)$ is:-

- Neither pointwise Convergent nor uniformly convergent
- Pointwise convergent but not uniformly convergent
- Uniformly convergent
- Divergent

31 of 100

199 PU_2015_118

The solution of the initial value problem $u_t = 4u_{xx}, t > 0, -\infty < x < \infty$ satisfying the condition $u(x,0) = x, u_t(x,0) = 0$ is:-

- 2x
- $\frac{x^2}{2}$
- x
- 2t

32 of 100

207 PU_2015_118

In a Boolean algebra, $a \leq b$ is not equivalent to:-

- $a' \wedge b = 1$
- $a \wedge b' = 0$
- $b' \leq a'$
- $a' \leq b'$

33 of 100

206 PU_2015_118

The fundamental cycles in a (p, q) - simple graph, having k ≥ 1 components is:-

- $p - q + k$
- $q - p + 1$

- $p + q + k$
- $q - p + k$

34 of 100

161 PU_2015_118

The number of elements in a minimal generating set of Q(w), where w = cube root of 2, over the field Q is:-

- 3
- 6
- 2
- 1

35 of 100

201 PU_2015_118

Which of the following is false?

- On every non compact subset E of R there exists a continuous function f: $E \to R$ which is not bounded
- There exists a non compact space X such that every continuous f: $X \to R$ is uniformly continuous
- If E is a non empty subset of R such that every continuous function f: $E \to R$ is uniformly continuous; then R is compact
- Every continuous real valued function defined on a compact metric space is uniformly continuous

36 of 100

183 PU_2015_118

Let R be an integral domain having n elements. Then:-

- n is a prime number
- n may be any finite integer
- n is a product of distinct prime numbers
- n need not be a prime number but it is a power of a prime number

37 of 100

184 PU_2015_118

In a ring R, consider the two statements.

i) If x.a = 0 for every a in R, then x = 0
ii) If x.x = x, then x = 1, the multiplicative identity of R.

Which one of the following is correct?

- i) is true but ii) is not true
- ii) is true but i) is not true
- Both i) and ii) are true
- Neither i) nor ii) is true

38 of 100
116 PU_2015_118

Let $\vec{F} = (x^2 + y - 4)\vec{i} + 3xy\vec{j} + (3xz + z^2)\overline{k}.$ Then $\nabla \times \vec{F}$ over the surface $x^2 + y^2 + z^2 = 16,\ z \geq 0$ is:-

- 4π
- -16π
- $\frac{7}{5}\pi$
- π

39 of 100
180 PU_2015_118

G has an element of order 7 only if:-

- o(G) = 7^n, for some n in N
- gcd (o(G), 7) = 1
- o(G) = 7.n for some n in N
- o(G) = 7

40 of 100
193 PU_2015_118

$tanh^{-1}x =$

- $\frac{1}{2}\log\left(\frac{1-x}{1+x}\right)$
- $\frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$
- $2\log\left(\frac{1+x}{1-x}\right)$
- $\log\left(x + \sqrt{x^2+1}\right)$

41 of 100
169 PU_2015_118

Let K be an extension of a field F and a in K. If a is algebraic over:-

- K, then a is algebraic over F
- K, then a is algebraic over any extension of F
- F, then a is algebraic over K
- Some extension of K, then a is algebraic over F

42 of 100

182 PU_2015_118

Let p divide the order of a finite group G and let G have k distinct p-sylow subgroups of G. Which one is not a correct statement?

- k is a multiple of p
- k is not a power of p
- k is a divisor of o(G)
- k is relatively prime to p

43 of 100

190 PU_2015_118

In Regula Falsi method, the first approxiation is given by:-

- $x_2 = x_0 + \frac{x_1 - x_0}{f(x_1) - f(x_0)} f\left(\frac{x_0}{2}\right)$
- $x_2 = x_0 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} f\left(\frac{x_0}{2}\right)$
- $x_2 = x_0 + \frac{x_1 - x_0}{f(x_1) - f(x_0)} f(x_0)$
- $x_2 = x_0 - \frac{x_1 - x_0}{f(x_1) - f(x_0)} f(x_0)$

44 of 100

167 PU_2015_118

Let a and b satisfies same irreducible polynomial f(x) over a field F. Then:-

- F(a) and F(b) need not be isomorphic but are extensions of same degree over F
- Any field extension of F containing a will also contains b and vice versa
- F(a) and F(b) are isomorphic with an isomorphism leaving every element of F fixed
- F(a) = F(b)

45 of 100

202 PU_2015_118

Consider *f*: [0,1] → *R* defined as $f(x) = \begin{cases} x^2 if\ x\ is\ rational \\ 0\ if\ x\ is\ irrational \end{cases}$. Then, the Lebesgue integral of *f* over [0,1] is:-

- $\frac{1}{3}$
- *f* is not Lebesgue integrable over [0,1]
- 0
- 1

46 of 100

131 PU_2015_118

The residue of *f*(*z*) = *cotz* at any of its poles is:-

- 1
- 0
- $2\sqrt{3}$
- $\sqrt{2}$

47 of 100

162 PU_2015_118

Let K be a field extension of F and L be a field extension of K. Which one is not correct?

- [K:F] divides [K:L]
- [K:K] divides [K:F]
- [L:K] divides [L:F]
- [K:F] divides [L:F]

48 of 100

187 PU_2015_118

In Eigen value (differential equation) problems:-

- Both Eigen values and Eigen functions are unique
- Eigen values but not Eigen functions are unique
- Eigen functions but not Eigen values are unique
- Eigen values and Eigen functions are not unique

49 of 100

133 PU_2015_118

The function $f(z) = |z|^2$ is:-

- Differentiable on real axis
- Not Differentiable anywhere
- Differentiable only at the origin
- Differentiable everywhere

50 of 100

160 PU_2015_118

Which one is a correct statement? The symmetric group:-

- S_3 is a direct product of subgroups isomorphic to Z_2, Z_2 and Z_2
- S_3 cannot be a direct product of its proper subgroups
- S_3 is a direct product of subgroups isomorphic to Z_2 and Z_3
- S_3 is a direct product of subgroups isomorphic to Z_4 and Z_2

51 of 100

168 PU_2015_118

In a splitting field K, of a polynomial f(x) over a field F. Then f(x) contains:-

- All the roots in K and the degree [K:F] is minimum
- Exactly one root and the degree [K:F] is minimum
- All the roots and the degree [K:F] is maximum
- At least one root

52 of 100

179 PU_2015_118
The center of a group G is always a:-

- Normal subgroup of G
- Proper subgroup of G
- Nontrivial subgroup of G
- Cyclic subgroup of G

53 of 100

166 PU_2015_118
Let f(x) be a polynomial over a field F of degree n. In any extension of F, f(x) will have:-

- At least n roots
- Exactly n roots
- Atleast one root
- At most n roots

54 of 100

181 PU_2015_118
Let G be the symmetric groups on 5 symbols. Then the number of distinct conjugate classes in G is:-

- 5
- 120
- 25
- 7

55 of 100

204 PU_2015_118
The radius of convergence of the power series $\sum_{n=1}^{\infty}\frac{1}{n}x^{n!}$ is:-

- *e*
- ∞
- 1
- 0

56 of 100

139 PU_2015_118

Let A and B be fuzzy sets, and the operation ∧ on fuzzy sets defined by:-

- $\mu_A(x) \wedge \mu_B(x) = \max\{\mu_A(x), \mu_B(x)\}$
- $\mu_A(x) \wedge \mu_B(x) = 0$
- $\mu_A(x) \wedge \mu_B(x) = |\mu_A(x) - \mu_B(x)|$
- $\mu_A(x) \wedge \mu_B(x) = \min\{\mu_A(x), \mu_B(x)\}$

57 of 100

208 PU_2015_118

The sum-of-products form of $(x_1 \oplus x_2)' * x_3$ is:-

- min 2
- min 1
- min 3
- min 0

58 of 100

118 PU_2015_118

If G is k-critical, then:-

- $\delta \geq k-1$
- $\delta \leq k-1$
- $\Delta \leq k-1$
- $\Delta \geq k-1$

59 of 100

114 PU_2015_118

If *A* and *B* are two nonempty subsets of a metric space (*X*, *d*), then which of the following is false?

- *A* and *B* are compact implies *A* ∪ *B* is compact
- *A* and *B* are connected implies *A* ∪ *B* is connected
- *A* and *B* are closed implies *A* ∪ *B* is closed
- *A* and *B* are compact implies *A* ∩ *B* is compact

60 of 100

205 PU_2015_118

The number of distinct simple graphs having *n* vertices are:-

- $2^{\frac{n(n-1)}{2}}$
- $2^{n(n+1)}$
- $2^{\frac{n(n+1)}{2}}$
- $2^{n(n-1)}$

61 of 100

254 PU_2015_118

If for a prime p, p^n divides, but p^{n+1} does not divide order of a finite group G, then:-

- For every d ≤ p^n, G has a subgroup of order d
- For every divisor d of o(G), G has a subgroup of order d
- For every positive integer r ≤ n, G has a subgroup of order p^r
- G has a subgroup of order p^r if r = n, but G need not have subgroups order p^r if r < n

62 of 100

220 PU_2015_118

Let f(x) be a polynomial over a field F and K be a field extension of F which contains all the roots of f(x) but no subfield of K contains all the roots of f(x). If an element a in K satisfies the property that g(a) = a for by all automorphisms g in G(K,F), then:-

- a is the multiplicative identity element 1
- a is the additive identity 0
- a need not be an element of F
- a is an element of F

63 of 100

229 PU_2015_118

The solution of the integral equation $3\sin 2x = y(x) + \int_0^x (x-t)y(t)dt$ is:-

- $-2\sin x + 4sin2x$
- $e^{-x}(x-1)^2$
- $x^3 + \frac{1}{20}x^5$
- $\cos x$

64 of 100

245 PU_2015_118

In a metric space (X,d):-

- Every infinite set E has a limit point in E
- Every closed subset of a compact set is compact
- Every subset of a compact set is closed
- Every closed and bounded set is compact

65 of 100

224 PU_2015_118

In Plane Poiseuille flow between two parallel plates the velocity profile is:-

- An ellipse
- A straight line
- A parabola
- A hyperbola

66 of 100

257 PU_2015_118

The Eigen values of the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ -1 & 0 & -4 \\ -2 & 4 & 0 \end{bmatrix}$ are:-

- (0,0,1)
- (1,2,4)
- $(i\sqrt{21}, -i\sqrt{21}, 0)$
- (-1,2,4)

67 of 100

251 PU_2015_118

Let a be an element of a group G of order mn, for some m,n in N. Then the number of elements in the conjugacy class of a cannot contain:-

- mn elements
- gcd (m,n) elements
- m elements
- 1 element

68 of 100

248 PU_2015_118

The inverse Laplace Transform of $\frac{(2s^2-4)}{(s-3)(s^2-s-2)}$ is:-

- $\frac{1}{3}e^{t} + \ te^{-t} + \ 2t$
- $\frac{7}{2}e^{3t} - \frac{1}{6}e^{-t} - \frac{4}{3}e^{2t}$
- $(1+t)\,e^{-t} + \frac{7}{2}e^{-3t}$
- $\frac{7}{2}e^{-3t} - \frac{1}{6}e^{t} - \frac{4}{3}e^{-2t}$

69 of 100

249 PU_2015_118

Consider the fuzzy relation R= { (x,y), μ_R(x,y)/ μ_R(x,y)∈[0,1], (x,y)∈ AxB}, where A&B are two fuzzy sets. The total projection of the fuzzy relation is:-

- $\min_x \min_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$
- $\max_x \max_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$
- $\max_x \min_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$

- $\min_x \max_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$

70 of 100

255 PU_2015_118

Let A be a nonzero commutative ring. Then:-

- A is isomorphic to a subring of a field, if A contains multiplicative identity element
- A is isomorphic to a subring of a field, only if A is a field
- A is isomorphic to a subring of a field, if A has no zero divisors but has multiplicative identity element
- A is always isomorphic to a subring of a field

71 of 100

226 PU_2015_118

The eigen values λ_n for the equation $y'' + \lambda y = 0$ with $y(-L) = 0, y(L) = 0$ when $L > 0$:-

- $\frac{n^2\pi^2}{L^2}$
- $n^2\pi^2$
- $\frac{2n^2\pi^2}{3L^2}$
- $\frac{n^2\pi^2}{4L^2}$

72 of 100

223 PU_2015_118

If the Helmholtz-Hodge Decomposition theorem, $\bar{w} = \bar{u} + \nabla p$, in a domain D, $\bar{u}$ satisfies:-

- $\nabla \times \bar{u} = 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D
- $\nabla.\bar{u} \neq 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D
- $\nabla.\bar{u} = 0$ in D and $\bar{u}.\bar{n} \neq 0$ on ∂D
- $\nabla.\bar{u} = 0$ in D and $\bar{u}.\bar{n} = 0$ on ∂D

73 of 100

247 PU_2015_118

A fuzzy set A is included in the fuzzy set B is denoted by $A \subseteq B$, if for all x in the universal set satisfies:-

- $\mu_B(X) = \mu_A(X)$
- $\mu_A(X) > \mu_B(X)$
- $\mu_B(X) \leq \mu_A(X)$
- $\mu_A(X) \leq \mu_B(X)$

74 of 100

246 PU_2015_118

The algebraic sum of fuzzy set A and B is defined by:-

- $\mu_{A+B}(x) = \mu_A(x)\mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x) + \mu_A(x)\mu_B(x)$
- $\mu_{A+B}(x) = \mu_A(x) + \mu_B(x) - \mu_A(x)\mu_B(x)$

75 of 100

256 PU_2015_118

Which of the following statements is true? A is a $n \times n$ square matrix.

- $A + A'$ is skew symmetric and $A - A'$ is symmetric
- Both $(A + A')$ and $(A - A')$ are skew symmetric
- $A + A'$ is symmetric and $A - A'$ is skew symmetric
- Both $(A + A')$ and $(A - A')$ are symmetric

76 of 100

225 PU_2015_118

If $x = x_0$ is a regular singular point of $y'' + P(x)y' + Q(x)y = 0$, then $P(x)$ has atmost:-

- Infinite number of poles
- Infinite number of zeros
- Single pole
- Ordinary point only

77 of 100

228 PU_2015_118

Let $P_n(x)$ be a Legendre polynomial then $P_n(x)$ satisfies:-

- $nP_{n+1}(x) = 2\,nxP_n(x) - P_{n-1}(x)$
- $(n+1)P_{n+1}(x) = (2\,n+1)xP_n(x) - nP_{n-1}(x)$
- $2\,p_n(x) = 3\;\,p_{n-1}(x) - p_{n+1}(x)$
- $xP_n'(x) = np_{n-1}(x) + p_{n+1}(x)$

78 of 100

253 PU_2015_118

Let G be a group and H is the set of all elements g in G such that the conjugate class containing g is {g}:-

- H is a normal subgroup of G but need not be the center of G
- H is abelian subgroup of G but need not be the center of G
- Then H is a trivial subgroup of G
- H is the center of G

79 of 100

252 PU_2015_118

Which one is not a correct statement: If G is a group:-

- If G is finite the number of elements in a conjugate class is a divisor of o(G)
- Union of all conjugate classes in G is G
- A conjugate class in G is a subgroup
- Intersection of any two distinct conjugate classes is empty

80 of 100
227 PU_2015_118

The solution of $x_{n+2} - 5x_{n+1} + 6x_n = 0$ when $x_0 = 2, x_1 = 3$:-

- $x_n = 3.2^n + 2.3^n$
- $x_n = 3.2^n - 3^n$
- $x_n = 3.2^n + 3^n$
- $x_n = 3.2^n - 2.3^n$

81 of 100
267 PU_2015_118

The Bessel's function $\{J_0(\alpha_k x)\}_{k=1}^{\infty}$ with αk denoting the kth zero of $j_0(x)$ form an orthogonal system on [0,1] with respect to weight function:-

- x^2
- 1
- $\sqrt{x}$
- x

82 of 100
270 PU_2015_118

Consider f: $R \to R$ defined as $(x) = \begin{cases} x^2 - 1 & if\ x\ is\ rational \\ 0 & if\ x\ is\ irrational \end{cases}$. Then:-

- f is discontinuous only at x = 1
- f is continuous nowhere on R
- f is discontinuous at x = -1 and x = 1
- f is discontinuous only at x = -1

83 of 100
287 PU_2015_118

The value of $I_n = \int_{c_n} \frac{1}{z^3 \sin z} dz, \quad n = 0, 1, 2, \ldots$ where c_n is the circle $|z| = (n + \frac{1}{2})\pi$ is:-

- $\sum_{k=1}^{n} (-1)^k k^n$
- $\frac{4i}{\pi^2} \sum_{k=1}^{n} \frac{(-1)^k}{k^3}$

- $\frac{4i}{\pi^3}\sum_{k=1}^{n}\frac{(-1)^k}{k^3}$
- $\sum_{k=1}^{n}(-1)^k k^{2n}$

84 of 100

266 PU_2015_118

Complete integral for the partial differential equation $z = px + qy - \sin(pq)$ is:-

- $z = ax + by + \sin(ab)$
- $z = ax + y + \sin(b)$
- $z = x + by + \sin(a)$
- $z = ax + by - \sin(ab)$

85 of 100

292 PU_2015_118

The number of zeros of the complex polynomial $3z^9 + 8z^6 + z^5 + 2z^3 + 1$ in the annulus $1 \le |z| < 2$ is:-

- 7
- 9
- 5
- 3

86 of 100

286 PU_2015_118

The value of $I = \frac{1}{2\pi i}\int_{|z|=1}\frac{(z+2)^2}{z^2(2z-1)}dz$ is:-

- 0
- $\frac{1}{2}$
- 2π
- $\frac{3}{4}$

87 of 100

265 PU_2015_118

For the Sturm Liouville problems $(1+x^2)y'' + 2xy' + \lambda x^2 y = 0$ with $y'(1) = 0$ and $y'(10) = 0$ the eigen values, λ, satisfy:-

- $\lambda < 0$
- $\lambda \le 0$
- $\lambda \ne 0$
- $\lambda \ge 0$

88 of 100

273 PU_2015_118

Consider $f: [-2, 1] \to R$ defined as $f(x) = |x|$ for all $x \in [-2, 1]$.
The total variation of f over $[-2, 1]$ is:-

- 0
- 2
- 1
- 3

285 PU_2015_118

The number of the roots of the polynomial $z^4 + z^3 + 1$, in the quadrant $\{z = x + iy \mid x,y > 0\}$ is:-

- 1
- 3
- 0
- 4

272 PU_2015_118

If $a_n = \sqrt[n]{4^{(-1)^n} + 2}$ for all $n \in N$, then:-

- $\limsup_{n\to\infty} a_n = 1$ and $\liminf_{n\to\infty} a_n = 0$
- $\limsup_{n\to\infty} a_n = 0$ and $\liminf_{n\to\infty} a_n = 0$
- $\limsup_{n\to\infty} a_n = 1$ and $\liminf_{n\to\infty} a_n = 1$
- $\limsup_{n\to\infty} a_n = 0$ and $\liminf_{n\to\infty} a_n = 1$

294 PU_2015_118

The number of edges of a simple graph with n vertices and with ω components is:-

- $\geq \frac{(n-\omega)(n-\omega-1)}{2}$
- $\leq \frac{(n-\omega)(n-\omega+1)}{2}$
- $\frac{(n-\omega)(n-\omega+1)}{2}$
- $\geq \frac{(n-\omega)(n-\omega+1)}{2}$

92 of 100

293 PU_2015_118

Let G be a group having p^n elements. Then:-

- Always there exists an element x in G, such that xg not equal to gx for some g in G
- For every x in G, xg = gx for every g in G
- There exists an element x in G, x not identity element, such that xg = gx for every g in G
- If for some x in G, xg = gx for every g in G then x = e, the identity element

93 of 100

290 PU_2015_118

The value of $I = \int_{-\infty}^{\infty} \frac{dx}{1+x^{2n}}$ when *n* is a positive integer is:-

- $\frac{\pi}{\sin\left(\frac{\pi}{4n}\right)}$
- $\frac{\pi}{n\sin\left(\frac{\pi}{2n}\right)}$
- $\frac{\pi}{n\sin\left(\frac{\pi}{4n}\right)}$
- $\frac{3\pi}{4\sin\left(\frac{\pi}{2n}\right)}$

94 of 100

288 PU_2015_118

Let $A = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{pmatrix}$, $B = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$

The general solution of the matrix differential equation $\frac{dX}{dt} = A \times B$ is:-

- $\sum_{i=0}^{3} \frac{t^i}{i!} A^i c_0 B^i$
- $\sum_{i=0}^{\infty} c_0 t^i AB$
- $\sum_{i=0}^{n} c_0 t^i AB^{-1}$
- $\sum_{i=0}^{n} t^i A c_0 B$

95 of 100

289 PU_2015_118

The value of $I = \int_{-\infty}^{\infty} \frac{\sin x}{x(x-\pi)} dx$ is:-

- $\frac{\pi}{4}$
- 2
- -2
- π

96 of 100

268 PU_2015_118

Which of the following satisfies the heat equation (without source term and with diffusion constant 1) in one space dimension?

- $\frac{e^{-x^2/4t}}{\sqrt{t}}$
- $x^2 - t$
- $e^t \sin x$
- $\sin\left[\frac{x^2}{4t}\right]$

97 of 100

271 PU_2015_118

Consider $f: R^2 \to R$ defined as $f(x,y) = \begin{cases} \frac{xy}{x^2+y^2} if(x,y) \neq (0,0) \\ 0 if(x,y) = (0,0) \end{cases}$. Then:-

- f is continuously differentiable on R^2
- f is continuous $(0,0)$ but not differentiable at $(0,0)$
- f is not continuous at $(0,0)$
- f is differentiable at $(0,0)$

98 of 100

269 PU_2015_118

If f (r,θ,φ) is a harmonic function in a domain D, where (r,θ,φ) are Spherical polar coordinates, then which of the following is also a harmonic function?

- $\frac{1}{r^2} f\left[\frac{1}{r^2},\theta,\varphi\right]$
- $\frac{1}{r} f(r,\theta,\varphi)$
- $\frac{1}{r^2} f\left[\frac{1}{r},\theta,\varphi\right]$
- $\frac{1}{r} f\left[\frac{1}{r},\theta,\varphi\right]$

99 of 100

295 PU_2015_118

Let X be a complete metric space. If X is represented as a union of a sequence of subsets of X, then:-

- The closure of at least one of the subset in the sequence has a non empty interior
- The closure of each of the subset in the sequence has a non empty interior
- The interior of each of the subset in the sequence is empty
- The interior of at least one of the subset in the sequence is empty

100 of 100

291 PU_2015_118

Let the sequence $a_0, a_1, \ldots$ be defined by the equation:

$$1 - x^2 + x^4 - x^6 + \cdots = \sum_{n=0}^{\infty} a_n (x-3)^n, \quad 0 < x < 1.$$

Then $\limsup_{n\to\infty} \left(|a_n|^{\frac{1}{n}} \right)$ is:-

- $\sqrt{10}$
- $\frac{1}{\sqrt{10}}$
- 10
- $\sqrt{2}$

118 PU Ph D Mathematics

1 of 100

146 PU_2016_118_E

The function $fz = |z|$ is:-

- not differentiable anywhere
- differentiable on real axis
- differentiable only at the origin
- differentiable everywhere

2 of 100

162 PU_2016_118_E

Consider the linear map $T: (C[a,b], ||.||_\infty) \to (C[a,b], ||.||_\infty)$ defined as $T(f)(x) = \int_a^x f(t)dt$

- T is bounded and $||T||$ = $b-a$
- T in not bounded
- T is bounded and $||T||$ < $b-a$
- T is bounded and $||T||$ > $b-a$

3 of 100

203 PU_2016_118_E

In a Boolean algebra **B,** for a, b in **B,** a ≤ b is equivalent to:-

- $b \leq a$
- $a \oplus b = 0$
- $a \leq b$
- $a * b = 1$

4 of 100

183 PU_2016_118_E

Suppose f is continuous on [a,b] and differentiable on (a,b). If f(a)=f(b), then there is a \ point $c \in (a, b)$ with:-

- $f(b) = 0$
- $f'(c) \neq 0$
- $f(a) = 0$
- $f'(c) = 0$

5 of 100

164 PU_2016_118_E

Consider the linear transformation $T: R^2 \to R^3$ defined as $T(x_1,x_2) = (x_1,x_1+x_2,x_2)$, then the nullity of T is:-

- 1

- 3
- 2
- 0

6 of 100

184 PU_2016_118_E

If $f : [a,b] \rightarrow R$ and $g : [a,b] \rightarrow R$ are both continuous on [a,b] and differentiable on (a,b), then there exists an $x_0 \in (a,b)$ such that:-

- $f(x_0)[g(b) - g(a)] = g'(x_0)[f(b) - f(a)]$
- $f'(x_0)[g(b) - g(a)] = g(x_0)[f(b) - f(a)]$
- $[g(b) - g(a)] = [f(b) - f(a)]$
- $f'(x_0)[g(b) - g(a)] = g'(x_0)[f(b) - f(a)]$

7 of 100

129 PU_2016_118_E

Let f: G --> H be a group homomorphism.

- If N is a normal subgroup of G then f(N) is a normal subgroup of H.
- f^{-1} (0) is a normal subgroup of G.
- If K is a normal subgroup of H then f^{-1}(K) need not be a normal subgroup of G.
- *f*(G) is a normal subgroup of H.

8 of 100

168 PU_2016_118_E

Let A and B be fuzzy sets, and the operation ^ on fuzzy sets defined by:-

- $\mu_A(x) \wedge \mu_B(x) = \max\{\mu_A(x), \mu_B(x)\}$
- $\mu_A(x) \wedge \mu_B(x) = |\mu_A(x) - \mu_B(x)|$
- $\mu_A(x) \wedge \mu_B(x) = 0$
- $\mu_A(x) \wedge \mu_B(x) = \min\{\mu_A(x), \mu_B(x)\}$

9 of 100

202 PU_2016_118_E

An ideal A of a commutative ring R with unity is maximal <=> R/A is a:-

- prime ideal
- ring
- field
- integral domain

10 of 100

206 PU_2016_118_E

The value of the integral $\int_c \cos z \, dz$, where c is $|z+\frac{1}{2}|=1/3$ is:-

- $-2\pi i$
- ∞
- $2\pi i$
- 0

11 of 100

126 PU_2016_118_E

Which one is not a correct statement?

- the center of a group G is abelian.
- the center of a group G is a normal subgroup of G.
- the center of a group G is non trivial when o(G) = 27.
- the center of a group G is always proper subgroup of G.

12 of 100

106 PU_2016_118_E

Let K be a field extension of F and L be a field extension of K.
Which one is not correct?

- [L:K] divides [L:F]
- [K:F] divides [L:F]
- [K:K] divides [K:F]
- [K:F] divides [L:K]

13 of 100

186 PU_2016_118_E

An operator T on a Hilbert space is self adjoint <=> for all *x*, *(T x, x)* is a:-

- $||x||^2$
- $||x||$
- real
- complex

14 of 100

122 PU_2016_118_E

Which one is a false? There exists a field having:-

- 125 elements

5 elements

16 elements

36 elements

15 of 100

204 PU_2016_118_E

Let G be a connected (p, q) - plane graph having r faces. Then p - q + r is:-

4

2

3

1

16 of 100

167 PU_2016_118_E

Let p be a positive number and let F_A be a fuzzy set with membership $\pi_A(x)$, $x \in A$. The fuzzy set on power p is defined as:-

$F_A^p = \{(x, (\mu_A(x))^p)\}$

$F_A^p = \{(x^p, \mu_A(x))\}$

$F_A^p = \{(x, \mu_A(x))\}$

$F_A^p = \{(x^p, (\mu_A(x))^p)\}$

17 of 100

102 PU_2016_118_E

If w is a primitive 11^{th} root of unity then the degree of Q(w) over Q is:-

2

11^2

10

11

18 of 100

207 PU_2016_118_E

The radius of convergence of the power series $\sum_{n=1}^{\infty} z^{n!}$ is:-

1

3

- $\frac{1}{2}$
- 0

19 of 100

123 PU_2016_118_E

Which one is a false? There exists a vector space having:-

- 27 elements
- 125 elements
- 8 elements
- 36 elements

20 of 100

163 PU_2016_118_E

Let E be a nonempty subset of R. Let $m^*(E)$ denote the Lebesgue outer measure of E. Then, which of the following is TRUE?

- E is countable if and only if $m^*(E) = 0$.
- Every $F\sigma$- subset of R is measurable
- If E is non measurable then $m^*(E) = \infty$
- If $m^*(E) > 0$ then E must contain an interval of positive length

21 of 100

104 PU_2016_118_E

Which one is a correct statement? The symmetric group:-

- S_3 cannot be a direct product of its proper subgroups
- S_3 is a direct product of subgroups isomorphic to Z_4 and Z_2
- S_3 is a direct product of subgroups isomorphic to Z_2, Z_2 and Z_2
- S_3 is a direct product of subgroups isomorphic to Z_2 and Z_3

22 of 100

185 PU_2016_118_E

A bounded and entire function $f(z)$ is:-

- constant
- bijective
- surjective
- identity

23 of 100

189 PU_2016_118_E

An analytic function $f(z) = u(z) + iv(z)$ with constant modulus is:-

- constant
- identity
- continuous
- bounded

24 of 100

143 PU_2016_118_E

Let f(x) belong to F[x], where F is a field.

(i) If F is the field of rational numbers and f(x) is irreducible then f(x) has no multiple roots.
(ii) If the derivative of f(x) is a zero polynomial then f(x) is a constant.

- (ii) is true but (i) is not true.
- Both (i) and (ii) are true.
- Neither (i) nor (ii) is true.
- (i) is true but (ii) is not true.

25 of 100

142 PU_2016_118_E

Let f(x) belong to F[x], where F is a field.

(i) F(a) is isomorphic to F(b) for any two roots a,b of f(x) in some extension of F.
(ii) K and L are two smallest feild extensions of F having all the roots of f(x) then K is isomorphic to L.

- (i) is true but (ii) is not true.
- (ii) is true but (i) is not true.
- Both (i) and (ii) are true.
- Neither (i) nor (ii) is true.

26 of 100

105 PU_2016_118_E

The number of elements in a minimal generating set of Q(w), (where w = cube root of 2) over the field Q is:-

- 6
- 2
- 1
- 3

27 of 100

165 PU_2016_118_E

π_A (X) and π_B (X) are two fuzzy membership functions. The intersection of the membership function is equal to:-

- 0
- 1-π_A (X).π_B (X)
- max { π_A (X), π_B (X)}
- min { π_A (X), π_B (X)}

28 of 100

209 PU_2016_118_E

If $f(z) = \frac{z-\sin z}{z^3}$ then $z = 0$ is a:-

- simple pole
- a point of essential singularity
- double pole
- point of removable singularity

29 of 100

208 PU_2016_118_E

The function *f : **C** → **C*** defined as *f : (z) = sinz* is:-

- Bounded but not periodic
- Both bounded and periodic
- Not bounded but periodic
- Neither bounded nor periodic

30 of 100

124 PU_2016_118_E

Let F subset of K subset of L be field extensions, where F having 4 elements. Then which one is possible:-

- L and K have 64 and 32 elements respectively
- L and K have 16 and 8 elements respectively
- L and K have 128 and 16 elements respectively
- L and K have 256 and 16 elements respectively

31 of 100

121 PU_2016_118_E

Let V be a n dimensional vector space and T be a linear transformation on V. Then T satisfies a polynomial over F:-

- always
- if rank T = n
- if T is right invertible

- if T is invertible

32 of 100

110 PU_2016_118_E

Let f(x) be a polynomial over a field F of degree n. In any extension of F, f(x) will have:-

- at most n roots
- exactly n roots
- at least one root
- at least n roots

33 of 100

125 PU_2016_118_E

In the following statements.

(i) a, b belong to same right coset of a subgroup H in G implies.

- $a^{-1}b$ belong to H
- $ab = e$, the identity element
- ab^{-1} belong to H
- $ab^{-1} = e$, the identity element

34 of 100

201 PU_2016_118_E

Let T and J be two topologies on a nonempty set X. Which is a topology on X ?

- T - J
- J - T
- $T \cap J$
- $T \cup J$

35 of 100

103 PU_2016_118_E

$ax^8 + 2bx^2 + 2c$ is irreducible if:-

- 2 does not divide both a and b
- 2 divides a but does not divides c
- 2 divides both b and c
- 2 does not divide both a and c

36 of 100

127 PU_2016_118_E

Let G be a finite group, H be a subgroup and g belong to G. Then:-

- $gHg^{-1} = e$
- gHg^{-1} contained in H but gHg^{-1} need not be equal to H.

- $gHg^{-1} = H$
- gHg^{-1} and H have same number of elements

37 of 100

147 PU_2016_118_E

Let f:[a, b] → R be a bounded function where a,b ∈ R with $a < b$. Then f is Riemann integrable if and only if f is continuous everywhere on [a,b] except on:-

- a set of positive measure
- a set measure zero
- a countably infinite number of points
- a finite number of points

38 of 100

101 PU_2016_118_E

Let G be a nonabelian group of order 6. Then the number of 2-Sylow subgroups is:-

- 0
- 3
- 1
- 2

39 of 100

190 PU_2016_118_E

The residue of $\frac{z^2}{z^2+a^2}$ at $z = ai$ is:-

- $\frac{ia}{2}$
- 0
- ia
- 1

40 of 100

107 PU_2016_118_E

Let K be an extension of F.

- If [F(a): F] is finite then a is not be algebraic over F
- For any element a in K every element of F(a) algebraic over F
- If an element a in K satisfies a polynomial over F then every element of F (a) is algebraic over F

Then every element of K is algebraic over F

41 of 100

100 PU_2016_118_E

Let G be a group of order 28. Then which one of the following statements is not True?

- G has no subgroup of order 4
- There exists only one subgroup of order 7
- Any subgroup of order 7is a normal subgroup
- G is not simple

42 of 100

144 PU_2016_118_E

The number of elements in a finite field is:-

- a square of a prime number
- a positive integer greater than one.
- a positive power of a prime number
- a square of an integer greater than one.

43 of 100

188 PU_2016_118_E

The order of the symmetric group S_n is:-

- n^n
- $(n + 1)!$
- $n!$
- n

44 of 100

109 PU_2016_118_E

Which one is the correct statement?

- All polynomial with zero derivative over a field of characteristic p have distinct roots
- Irreducible polynomials over a field of characteristic p have distinct roots
- Irreducible polynomials over finite fields have distinct roots
- All the polynomials over a field of characteristic zero have distinct roots

45 of 100

210 PU_2016_118_E

The value of $\oint_{|z|=1} \dfrac{\sin^2 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ is:-

- πi
- $2\pi i$
- 0
- $\frac{\pi i}{6}$

46 of 100

170 PU_2016_118_E

A fuzzy set A is included in the fuzzy set B is denoted by $A \subseteq B$, if for all x in the universal set satisfies the condition _____________.

- $\pi_A (X) \leq \pi_B (X)$
- $\pi_B (X) = \pi_A (X)$
- $\pi_B (X) \leq \pi_A (X)$
- $\pi_A (X) > \pi_B (X)$

47 of 100

181 PU_2016_118_E

The series $\sum_{n=1}^{\infty} \frac{1}{n^2}$ is:-

- Bounded above by 0
- Oscillating series
- Convergent
- Divergent

48 of 100

148 PU_2016_118_E

Let *E* be the set of rational numbers *p* such that *2 < p2 < 3*. Then *E* is:-

- not compact in *Q*
- closed but not bounded in *Q*
- compact in *Q*
- bounded but not closed in *Q*

49 of 100

150 PU_2016_118_E

Let $f_n(x) = \frac{1}{1+nx}$ for all $x \in [0,1]$ and for all $n \in N$. Then the sequence of functions $(f_n)_{n=1}^{\infty}$

- Pointwise bounded but not uniformly bounded on [0,1]

- the sequence $(f_n)_{n=1}^{\infty}$ is not uniformly convergent on [0,1] but it has a subsequence which is uniformly convergent on [0,1]
- the sequence $(f_n)_{n=1}^{\infty}$ converge uniformly on [0,1]
- Pointwise convergent but not uniformly convergent on [0,1]

50 of 100

149 PU_2016_118_E

Let *A* be the set of points in the interval [0,1] representing the numbers whose expansion as infinite decimals do not contain the digit 7 then the measure of *A* is:-

- ∞
- $\frac{1}{2}$
- 0
- 1

51 of 100

145 PU_2016_118_E

The function $f(x,y) = (e^x \cos y, e^x \sin y)$ from R^2 to R^2 is:-

- such that some neighbourhood of any point surjects on to R^2
- one to one on some neighbourhood of any point in R^2
- One to one on all of R^2
- an Onto Map

52 of 100

141 PU_2016_118_E

Let F be a field and a, b are in some field extension K of F. If a and b are algebraic over F. Then which is not a correct statement.

- $a + b$ is algebraic over F
- $ka + lb$ is algebraic over F for every l, k belong to K.
- ab is algebraic over F
- $a^2 + b^2$ is algebraic over F

53 of 100

166 PU_2016_118_E

Consider the fuzzy relation R = { (x,y), $\pi_R(x,y)$ / $\pi_R(x,y) \in [0,1]$, $(x,y) \in A\times B$}, where A&B are two sets. The total projection of the fuzzy relation is = ?

- $\max_x \min_y \{\mu_R(x,y)/\mu_R(x,y) \in [0,1], (x,y) \in AxB\}$
- $\max_x \max_y \{\mu_R(x,y)/\ \mu_R(x,y) \in [0,1], (x,y) \in AxB\}$
- $\min_x \min_y \{\mu_R(x,y)/\ \mu_R(x,y) \in [0,1], (x,y) \in AxB\}$
- $\min_x \max_y \{\mu_R(x,y)/\ \mu_R(x,y) \in [0,1], (x,y) \in AxB\}$

54 of 100

128 PU_2016_118_E

Let N be a subgroup of G. Then the binary operation defined as aN.bN = abN is need not be well defined:-

- if N is a proper subgroup of G.
- if G is an abelian group.
- if N is a normal subgroup of G.
- if N is a center of G.

55 of 100

108 PU_2016_118_E

Let K is a field extension of F and an element a in K satisfies the polynomial of degree n over F. Then:-

- n/ [F(a) :F]
- [F(a) :F] ≤ n but need not be equal to n
- [F(a) :F] = n
- [F(a): F] need not be finite

56 of 100

169 PU_2016_118_E

Let p and q be any two propositions whose truth value belong to the truth value set {0, 1}. The implication is defined by:-

- $p \rightarrow q = \min\{1, 1 + q - p\}$
- $p \rightarrow q = \max\{1, 1 + q + p\}$
- $p \rightarrow q = \max\{1, 1 + q - p\}$
- $p \rightarrow q = \min\{1, 1 + q + p\}$

57 of 100

182 PU_2016_118_E

Let $\{a_n\}$, $\{b_n\}$ and $\{x_n\}$ be sequences such that $a_n \le x_n \le b_n$, $\forall n \in N$. Suppose that $\{a_n\}$ and $\{b_n\}$ are convergent sequences and $Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$. Then $\{x_n\}$ converges:-

- $Lt_{n\to\infty} x_n \neq Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n > Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n < Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$
- $Lt_{n\to\infty} x_n = Lt_{n\to\infty} a_n = Lt_{n\to\infty} b_n$

58 of 100

187 PU_2016_118_E

The n^{th} - Legendre polynomial $p_n(x)$ is such that $\int_{-1}^{1} p_n(x)^2\, dx$ is :-

- $\frac{2}{2n-1}$
- π
- $\frac{2}{2n+1}$
- $\sqrt{\frac{\pi}{2}}$

59 of 100

205 PU_2016_118_E

The residue of $\dfrac{ze^z}{(z-a)^3}$ at $z=a$ is:-

- a
- $\frac{1}{2}e^a(a+z)$
- $a + z$
- e^a

60 of 100

161 PU_2016_118_E

Consider the linear map $T:(l_2, ||.||_2) \to (l_2, ||.||_2)$ defined as $T(x_1, x_2, x_3, \ldots) = \left(x_1, \frac{x_2}{2}, \frac{x_3}{3}, \frac{x_4}{4}, \ldots\right)$. Then:-

- *T* in not bounded

- T is bounded and $||T||<1$
- T is bounded and $||T|| = 1$
- T is bounded and $||T||>1$

61 of 100

224 PU_2016_118_A

The value of the constant "a" so that $u(x,y) = ax^2 - y^2 + xy$ is harmonic:-

- 1
- 2
- 0
- -1

62 of 100

249 PU_2016_118_A

The first approximation for the solution of the following simultaneous equations:-

20 x + y -2 z = 17
3 x + 20 y - z = -18
2 x -3 y + 20 z = 25

by Jacobi's method with initial values $x_0 = y_0 = z_0 = 0$ is:-

- 0.95, -0.9, 1.20
- 0.85, -0.9, 1.25
- .6, 0.9, 1.25
- 0.86, -0.80, 1.20

63 of 100

243 PU_2016_118_A

If G is regular bipartite graph then:-

- G has a cut vertex
- G is 2-factorable
- G is 1-factorable
- G has a cut edge

64 of 100

223 PU_2016_118_A

A complex number represented by the point (0,1,0) is:-

- i
- -i
- -1
- 1

65 of 100

242 PU_2016_118_A

Which of the following is false?

- All projections are both open and closed
- All projections are closed but may not be open
- All projections are neither open nor closed
- All projections are open but may not be closed

66 of 100

247 PU_2016_118_A

Match the list I and List II:-

List I	List II
(I) Newton-Raphson	(P) Integration
(II) Runge Kutta	(Q) Root Finding
(III) Gauss Seidel	(R) Ordinary Differential Equations
(IV) Simpson's Rule	(S) System of Linear equations

- I-Q, II-S, III-R, IV-P
- I-Q, II-R, III-S, IV-P
- I-P, II-Q, III-R, IV-S
- I-Q, II-R, III-P, IV-S

67 of 100

220 PU_2016_118_A

If p is a prime and (a,p) =1 then:-

- $p^a \equiv 1 \pmod{a}$
- $a^p \equiv 1 \pmod{p}$
- $a \equiv 1$ ($p$mod$p$)
- $a^{p-1} \equiv 1 \pmod{p}$

68 of 100

227 PU_2016_118_A

When will pointwise convergence imply uniform convergence of a sequence of real valued functions $\{f_n\}$ defined on [a,b].

- $\{f_n\}$ are uniformly bounded on [0,1]
- $\{f_n\}$ are uniformly continuous on [0,1]
- $\{f_n\}$ are continuous on [0,1]
- $\{f_n\}$ are equi-continuous on [0,1]

69 of 100

246 PU_2016_118_A
In Newton-Raphson method, nth approximation is given by:-

- $x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})}$
- $x_n = x_{n-1} + \frac{f(x_{n-1})}{f'(x_{n-1})}$
- $x_n = x_{n-1} + \frac{f'(x_{n-1})}{f(x_{n-1})}$
- $x_n = x_{n-1} - \frac{f'(x_{n-1})}{f(x_{n-1})}$

70 of 100

221 PU_2016_118_A
The remainder when 41^{75} is divided by 3 is:-

- 3
- 1
- 2
- 5

71 of 100

228 PU_2016_118_A
If G is k-critical, then:-

- $\delta \leq k$ -1
- $\Delta \geq k$ -1
- $\Delta \leq k$ -1
- $\delta \geq k$ -1

72 of 100

225 PU_2016_118_A

Let $f_n(x) = \frac{x^n}{1+x^n}$ $(0 \leq x \leq 1)$. Which of the following is wrong?

- $\{f_n\}$ is pointwise bounded on [0,1].
- $\{f_n\}$ is pointwise convergent on [0,1].
- $\{f_n\}$ is uniformly convergent on [0,1].
- $\{f_n\}$ is uniformly bounded on [0,1].

73 of 100

244 PU_2016_118_A
Every convergent sequence in a topological space X has a unique limit if:-

X is a compact space

X is a second countable space

X is a T_1-space

X is a Hausdorff space

74 of 100

241 PU_2016_118_A

Let X be the set of all real number with the topology consisting of the empty set together with all subsets of X whose complements are finite. Then any infinite subset of X is:-

closed

dense

open

compact

75 of 100

229 PU_2016_118_A

If G is a tree with n vertices then the number of ways to properly color G using λ colors is:-

$(\lambda - 1)^{n-1}$

$(\lambda)^{n-1}$

$(\lambda - 1)\lambda^{n-1}$

$\lambda (\lambda - 1)^{n-1}$

76 of 100

245 PU_2016_118_A

The maximum error associated with the composite Simpson's rule is:-

$-\frac{h^4}{180}(b-a)f^4(\xi)$

$-\frac{h^4}{90}(b-a)f^4(\xi)$

$-\frac{h^5}{90}f^4(\xi)$

$-\frac{h^5}{180}(b-a)f^4(\xi)$

77 of 100

222 PU_2016_118_A

An integer is prime if and only if it satisfies:-

(p-1)! ≡ -1(mod p)

(p-1)! 1 ≡ (mod p)

p!1 ≡ (mod p)

(p+1)! ≡ -1 (mod p)

78 of 100

226 PU_2016_118_A

Consider the series $\sum_{n=0}^{\infty} x(1-x)^n, (0 \le x \le 1)$. Then the series:-

- converges pointwise on [0,1]
- has a continuous limit on [0,1]
- has a uniformly convergent subsequence on [0, 1]
- converges uniformly on [0,1]

79 of 100

230 PU_2016_118_A

Let $M = \begin{bmatrix} 1 & 3 & 3 \\ 0 & 4 & 5 \\ 0 & 0 & 9 \end{bmatrix}$. Then:-

- neither M nor M^2 is diagonalizable
- M is diagonalizable but not M^2
- M^2 is diagonalizable but not M
- both M and M^2 are diagonalizable

80 of 100

248 PU_2016_118_A

The second approximation for the root of the equation 3x = Cos x + 1 between 0 and 1 with $x_0 = 0.6$ by Newton Raphson method is:-

- 0.607
- 0.517
- 0.350
- 0.606

81 of 100

263 PU_2016_118_D

The inverse Laplace Transform of $\frac{(2s^2 - 4)}{(s-3)(s^2 - s - 2)}$ is:-

- $\frac{1}{3}e^{t} + \ te^{-t} + \ 2t$
- $\frac{7}{2}e^{-3t} - \ \frac{1}{6}e^{t} \ - \frac{4}{3}e^{-2t}$
- $\frac{7}{2}e^{3t} - \ \frac{1}{6}e^{-t} \ - \ \frac{4}{3}e^{2t}$
- $(1+t)\,e^{-t} + \ \frac{7}{2}e^{-3t}$

82 of 100

283 PU_2016_118_D

If **u** is the velocity of an incompressible fluid flow in a domain D then **u** is:-

- curl free in D
- arbitrary in D
- divergence free in D
- both divergence and curl free

83 of 100

288 PU_2016_118_D

In the Couette flow with velocity (0,A/r + Br,0) the vorticity is given by:-

- (0,0,2B)
- (0,0,2A)
- (0,A.B)
- (0,0,0)

84 of 100

287 PU_2016_118_D

For the pde $\mathbf{v_t} - \mathbf{v_x}= 0$, the characteristics are:-

- hyperbolas
- circles
- arbitrary curves
- straight lines

85 of 100

269 PU_2016_118_D

The equation $(a\ xy^3 + y\cos x)\ dx+(x^2\ y^2+\beta \sin x)\ dy = 0$ is exact for:-

- $\alpha = 1, \beta = \frac{2}{3}$
- $\alpha = \frac{3}{2}, \beta = 1$

- $\alpha = \frac{2}{3}, \beta = 1$
- $\alpha = 1, \beta = \frac{3}{2}$

86 of 100
267 PU_2016_118_D

Let $f = y^x$. What is $\frac{\partial^2 f}{\partial x \partial y}$ at x=2, y=1?

- log2
- 0
- 1
- $\frac{1}{log2}$

87 of 100
289 PU_2016_118_D
In Poiseuille flow in a pipe of radius **a** the mass flow rate is proportional to:-

- $\mathbf{a}^3$
- **a**
- $\mathbf{a}^2$
- $\mathbf{a}^4$

88 of 100
281 PU_2016_118_D
If the Helmholtz-Hodge decomposition gives **w** =**u** + grad(p), in a domain **D** then:-

- **u** is normal to the boundary
- **u** is curl free
- **u** is arbitrary
- **u** is divergence free and is parallel to the boundary

89 of 100
265 PU_2016_118_D

The general solution of $y' + \frac{x}{1+x} y = 1 + x$ where C is an arbitrary constant is:-

- $y(x) = 1 + x + C$

- $y(x) = e^{-x}\,(x + \frac{x^2}{2} + C)(1 + x)$
- $y(x) = (1 + C\,e^{-x})\,(1 + x)$
- $y(x) = C\,(1 + x)$

90 of 100
261 PU_2016_118_D

Which p (t) is a solution of the Differential Equation $\frac{dp}{dt} = p\,(1 - p)$?

- $p\,(t) = \frac{e^t}{1+e^{-t}}$
- $p\,(t) = \frac{e^t}{1+e^t}$
- $p\,(t) = \frac{1}{1+e^{-t}}$
- $p\,(t) = \frac{e^{-t}}{1+e^t}$

91 of 100
260 PU_2016_118_D
$tanh^{-1}\,x =$

- $\frac{1}{2}\log\left(\frac{1-x}{1+x}\right)$
- $2\log\left(\frac{1+x}{1-x}\right)$
- $\frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$
- $\log\left(x + \sqrt{x^2 + 1}\right)$

92 of 100
270 PU_2016_118_D
The Laplace transform H(p) of the Heaviside function is given by:-

- p^2
- $1/p^2$
- 1/p
- p

93 of 100
285 PU_2016_118_D
If **W** is the specific enthalpy, p the pressure, ρ the density then d**W** is equal to:-

- dp / Ᵽ g
- d Ᵽ
- d (p + Ᵽ)
- dp

94 of 100

266 PU_2016_118_D

The partial differential equation obtaining by eliminating a and b from *z* = *ax* + *(1 - a) y* + *b* is:-

- $\left(\frac{\partial z}{\partial x}\right) = \left(\frac{\partial z}{\partial y}\right)$
- $\left(\frac{\partial z}{\partial x}\right)\left(\frac{\partial z}{\partial y}\right) = 1$
- $\left(\frac{\partial z}{\partial x}\right) - \left(\frac{\partial z}{\partial y}\right) = 1$
- $\left(\frac{\partial z}{\partial x}\right) + \left(\frac{\partial z}{\partial y}\right) = 1$

95 of 100

282 PU_2016_118_D

In the Plane Poiseuille flow the velocity profile is a:-

- ellipse
- straight line
- parabola
- hyperbola

96 of 100

264 PU_2016_118_D

Which of the following differential equations are equivalent to $\frac{d(e^x y)}{dx} = e^x x$?

- $\frac{dy}{dx} = x$
- $\frac{dy}{dx} = x - y$
- $\frac{dy}{dx} = x + y - 1$
- $\frac{dy}{dx} = x + y$

97 of 100

268 PU_2016_118_D

The complete solution of $\left(\frac{\partial z}{\partial x}\right)\left(\frac{\partial z}{\partial y}\right) = 1$ is:-

- z = ax+by+c
- $z= ax+\frac{y}{a}+c$
- $z=\frac{x}{a}+\frac{y}{b}+c$
- $z= ax+\frac{y}{b}+c$

286 PU_2016_118_D

If **D** is the deformation tensor of an incompressible fluid flow then the trace of **D** is

- an arbitrary function of position and time
- an arbitrary constant
- one always
- zero always

262 PU_2016_118_D

The sum of the squares of the roots of $x^3 + ax^2 - bx + c = 0$ is:-

- $b^2 - 2c$
- $a^2 - 2b$
- $a^2 + 2b$
- $a^2 + 2c$

284 PU_2016_118_D

If J (**x**,t) is the Jacobian of the fluid flow map of an incompressible fluid in a domain D then:-

- J = 0 in D
- J is arbitrary
- J = 1 in D
- J is arbitrary but constant

Examination: **Ph.D. Mathematics**

Section 1 - Section 1

Question No.1 4.00

Bookmark

The statement “The dual space of a non-empty normed linear space is non-empty” follows from

- closed graph theorem
- Riez representation theorem
- Uniform boundedness theorem
- Hahn-Banach theorem

Question No.2 4.00

Bookmark

Let V be a normed vector space. All norms on V are equivalent if V is

- finite dimensional
- reflexive
- complete
- an inner product space

Question No.3 4.00

Bookmark

Choose the correct meaning of the italicized idiom.
Anil got me into trouble by giving a *false colour* to my statement.

- Colouring the sentence
- Giving a wrong character
- Giving good impression
- Giving a wrong colour box

Question No.4 4.00

Bookmark

The general solution of $\frac{d^3y}{dx^3} - \frac{6d^2y}{dx^2} + \frac{11dy}{dx} - 6y = 0$ is

- $y = A + Be^{2x} + ce^{3x}$
- $y = Ae^{x} + Be^{2x} + ce^{3x}$
- $A - Be^{2x} + ce^{3x}$
- $y = Ae^{x} + be^{2x} - ce^{3x}$

Question No.5 4.00

Bookmark

The derived set of the set $X = \{\frac{1}{m} + \frac{1}{n} : m, n = 1, 2, 3, \ldots\}$ is

- $\{\frac{1}{n} : n = 1, 2, 3, \ldots\}$
- $\{0\}$
- X
- $X \cup \{0\}$

Question No.6 4.00

Bookmark

In any system of particles, suppose we do not assume that the internal force come in pairs. Then the fact that the sum of internal force is zero follows from

- Principle of virtual energy
- Newton's Second law
- Conservation of angular momentum
- Conservation of energy

Question No.7 4.00

Bookmark

The equation $(\alpha xy^3 + ycosx)dx + (x^2y^2 + \beta sin\, x)dy = 0$ is exact for

- $\alpha = 1, \beta = \frac{2}{3}$
- $\alpha = \frac{2}{3}, \beta = 1$
- $\alpha = 1, \beta = \frac{3}{2}$
- $\alpha = \frac{3}{2}, \beta = 1$

Question No.8 4.00

Bookmark

Let ℓ_2 be the set of real sequences $\{x_n\}$ such that $\sum_{n=1}^{\infty} |x_n^2| < \infty$. For $x \in \ell_2$, define $\|x\|^2 = \sum_{n=1}^{\infty} |x_n^2|$. Let $S = \{x \in \ell_2 : \|x\| < 1\}$. Then

- interior of S is compact
- S is compact
- closure of S is not compact
- closure of S is compact

Question No.9 4.00

Bookmark

Assertion: - India's president is appointed on a five-year term

Reason: -PratibhaPatil was appointed as India's first woman president in 2007

- A is true but R is false
- Both A and R are true and R is not the correct explanation of A
- A is false but R is true
- Both A and R are true and R is the correct explanation of A

Question No.10 4.00

Bookmark

If $\{a_n^2\}$ is convergent, then $\{a_n\}$ is

- may converge
- must converge
- may diverge to ∞
- must diverge

Question No.11 4.00

Bookmark

Let $y_1(x)\&y_2(x)$ be the solutions of the linear differential equation

$y'' - \frac{3}{x}y' + (sin2x)y = 0$ on the interval $[1, \infty)$ for which $y_1(1) = 0, y_1'(1) = 3$ and

$y_2(1) = 2,\ y_2'(1) = 1$. Then the Wronskian is

- $6x^3$
- $-6x^3$
- $-2x^2$
- $2x^2$

Question No.12 4.00

Bookmark

The four vectors (1,1,0,0), (1,0,0,1), (1,0,a,0) and (0,1,a,b) are linearly independent if

- $a \neq -2,\ b \neq 0$
- $a \neq 0,\ b \neq -2$
- $a \neq 0,\ b \neq 2$
- $a \neq 2,\ b \neq 0$

Question No.13 4.00

Bookmark

The only two limit points of the set $\left\{-1-\frac{1}{n} : n \in N\right\} \cup \left\{1+\frac{1}{n} : n \in N\right\}$ are

- ± 1/2
- ± 1
- ± 2
- 0

Question No.14 4.00

Bookmark

The function $f(z) = \frac{e^z - 2}{z-2}$ has

- an essential singularity at z = 2
- a simple pole at z = 2
- a double pole at z = 2
- a regular point at z = 2

Question No.15 4.00

Bookmark

Let X and Y be normed linear spaces. Every linear map from X to Y is continuous if

- $dim(Y) = 1$
- $dim(X) < \infty$
- $X = \ell^2$
- $dim(Y) < \infty$ D

Question No.16 4.00

Bookmark

Let $f(x) \in \mathbb{Z}[x]$ be a polynomial of degree ≥ 2. Pick each correct statement from below:

- If $f(x)$ is irreducible in $\mathbb{Z}[x]$, then it is irreducible in $\mathbb{Q}[x]$
- If $f(x)$ is irreducible in $\mathbb{Z}[x]$, then it is irreducible in $\mathbb{F}_p[x]$
- If $f(x)$ is irreducible in $\mathbb{Q}[x]$, then it is irreducible in $\mathbb{Z}[x]$
- If $f(x)$ is irreducible in $\mathbb{Z}[x]$, then it is irreducible in $\mathbb{R}[x]$

Question No.17 4.00

Bookmark

In a code language, 321 means "Hot Black Coffee", 536 means "Very Hot Summer", and 589 means "Summer and Winter". Which digit stands for "Very" ?

- 6
- 5
- 9
- 3

Question No.18 4.00

Bookmark

The equation $y - 2x = a$ represents the orthogonal trajectories of the family

- $x^2 + 2y^2 = c$
- $y = ce^{-2x}$
- $xy = c$
- $x + 2y = c$

Question No.19 4.00

Bookmark

In $\mathbb{R}^3$ with usual topology, let $V = \{(x,y,z) \in \mathbb{R}^3 : x^2+y^2+z^2 = 1, y \neq 0\}$ and $W = \{(x,y,z) \in \mathbb{R}^3 : y = 0\}$. Then $V \cup W$ is

- connected and compact
- compact but not connected
- neither connected nor compact
- connected but not compact

Question No.20 4.00

Bookmark

The number of arbitrary constants in a differential equation of order m and degree n is p. Then

- p = m
- p < m
- p < n
- p = n

Question No.21 4.00

Bookmark

Study the following information carefully and answer the question below it

The Director of an MBA college has decided that six guest lectures on the topics of Motivation, Decision Making, Quality Circle, Assessment Centre, Leadership and Group Discussion are to be organised on each day from Monday to Sunday.
(i) One day there will be no lecture (Saturday is not that day), just before that day Group Discussion will be organised.
(ii) Motivation should be organised immediately after Assessment Centre.
(iii) Quality Circle should be organised on Wednesday and should not be followed by Group Discussion
(iv) Decision Making should be organised on Friday and there should be a gap of two days between Leadership and Group Discussion

How many lectures are organised between Motivation and Quality Circle?

- Two
- Four
- One
- Three

Question No.22 4.00

Bookmark

Let E be a connected subset of R with at least two elements. Then the number of elements in E is

- Exactly two
- Uncountable
- Countably infinite
- More than two but finite

Question No.23 4.00

Bookmark

The topology τ on the real line $\mathbb{R}$ generated by all the closed intervals $[d, d+1]$ with length 1 is

- standard topology
- neither discrete nor Hausdorff
- discrete
- indiscrete

Question No.24 4.00

Bookmark

$f(z) = e^z$ is conformal

- at every point $\mathbb{C}$
- only at $z = 0$
- at no point in $\mathbb{C}$
- at every point except 0 in $\mathbb{C}$

Question No.25 4.00

Bookmark

Let K(x,y) be a given real function defined for 0≤x≤1, 0≤y ≤ 1 and f(x) a real valued

function defined for 0≤x≤1 and λ an arbitrary complex number.

Then $\int K(x,y)\phi(y)dy = f(x)$,0≤x≤1 is the

- Linear Fredholm integral equation of first kind(for a function ϕ(x))
- Linear Fredholm integral equation of second kind(for a function ϕ(x))
- Volterra integral equation of second kind (for a function ϕ(x))
- Volterra integral equation of second kind(for a function ϕ(x))

Question No.26 4.00

Bookmark

Every bilinear transformation maps circles or straight lines into

- straight lines
- circles
- circles or straight lines respectively
- straight lines or circles respectively

Question No.27 4.00

Bookmark

Given, $f(z) = \int_c \frac{z^2 - z + 1}{z-1} dz$ where C is a circle $|z| = \frac{1}{4}$

- $f(z)$ is not analytic
- f(z) ≠0
- f(z) is analytic everywhere within C
- f(z) has no simple pole

Question No.28 4.00

Bookmark

The integrating factor of the differential equation $dx + (1 + x + y)dy = 0$ is

- $-\frac{1}{x+y}$
- $\frac{1}{x+y}$
- $x + y$
- $\log(x + y)$

Question No.29 4.00

Bookmark

The number of multiples of 10^{44} that divides 10^{55} is

- 121
- 2
- 1
- 144

Question No.30 4.00

Bookmark

The last two digits of 7^{81} are a

- 37
- 17
- 7
- 47

Question No.31 4.00

Bookmark

The set of natural numbers N is a

- dense set
- somewhere dense set
- dense in itself
- non dense set

Question No.32 4.00

Bookmark

Obtain the missing term.

300, 296, 287, 271, ? , 210

- 246
- 250
- 244
- None of the above

Question No.33 4.00

Bookmark

Ramesh had a cold and couldn't go to the party, so I bought him a cake to make up for his______

- disappointment
- disillusion
- depression
- disgust

Question No.34 4.00

Bookmark

Given the functional $F = F(x, y, y')$, the differential equation $\frac{\partial F}{\partial y} - \frac{d}{dx}(\frac{\partial F}{\partial y'}) = 0$ is referred as

- Lagrange's equation
- Cayley equation
- Hamilton equation
- Euler's characteristic equation

Question No.35 4.00

Bookmark

The set of all limits points of the set of all rational numbers is

- $\mathbb{Q}$
- ϕ
- $\mathbb{R}$
- $\mathbb{R} \setminus \mathbb{Q}$

Question No.36 4.00

Bookmark

A non-separable Banach space is

- $L^\infty[0, 1]$
- $L^1[0, 1]$

○ $C[0,1]$

○ $L^2[0,1]$

Question No.37 4.00

Bookmark ☐

The number of group homomorphisms from the symmetric group S_3 to $\mathbb{Z}_6$ is

○ 6
○ 3
○ 1
○ 2

Question No.38 4.00

Bookmark ☐

A topological space X is totally disconnected, if

○ its only connected subsets are empty set and set X itself
○ its only connected subsets are set X itself
○ its only connected subsets are empty set
○ its only connected subsets are one-point set

Question No.39 4.00

Bookmark ☐

The space ℓ_p is a Hilbert space if and only if

○ $p = \infty$

○ $p = 2$

○ p is even

○ $p > 1$

Question No.40 4.00

Bookmark ☐

The number of elements in the set
$\{m : \; 1 \leq m \leq 1000, \; m \text{ and } 1000 \text{ are relatively prime}\}$ is

○ 400
○ 250
○ 300
○ 100

Question No.41 4.00

Bookmark ☐

Consider $\mathbb{Z}_5$, the field of congruence modulo 5 classes and let $f(x) = x^5 + 4x^4 + 4x^3 + 4x^2 + x + 1$. Then the multiplicities of zeros 1 and 3 of $f(x)$ over $\mathbb{Z}_5$ are respectively

○ 1 and 4
○ 2 and 2
○ 2 and 3
○ 1 and 2

Question No.42 4.00

Bookmark ☐

Let $S : \mathbb{R}^6 \longrightarrow \mathbb{R}^6$ be a linear mapping satisfying $S^2 = 0$. Then the rank of S is

- >3
- ≤ 3
- 5
- 6

Question No.43 4.00

Bookmark ☐

Statements: Some bats are snakes, No snake is dangerous
Conclusion:
I. Some dangerous animals are snakes
II. Some bats are not dangerous.

- If only conclusion I follows
- If either I or II follows
- If only conclusion II follows
- If neither I nor II follows

Question No.44 4.00

Bookmark ☐

The radius of convergence of the power series $\sum n^p z^n$ is

- ∞
- 0
- 1
- 2

Question No.45 4.00

Bookmark ☐

A connected regular graph G with 10 vertices and 25 edges is

- planar
- bi-partite
- Eulerian
- non-planar

Question No.46 4.00

Bookmark ☐

The number non-isomorphic fields with exactly 6 elements is

- 0
- 3
- 1
- 2

Question No.47 4.00

Bookmark ☐

If a function f is analytic within and on a simple closed contour C, then $\int_C f(z)dz$ is

- ∞
- 1
- 0
- non-zero

Question No.48 4.00

Bookmark ☐

Given $f(z) = \log z$

- $\frac{df(z)}{dz}$ is defined for z = 0
- f(z) is not analytic
- f(z) does not satisfies Cauchy –Riemann equation
- f(z) is analytic

Question No.49 4.00

Bookmark ☐

The sequence $\{a_n\}$ where $a_n = \frac{1}{\ } + \frac{1}{\ } + \cdots + \frac{1}{\ }$ is

The sequence $\{a_n\}_n$ where $a_n = \frac{1}{1.3} + \frac{1}{3.5} + \cdots + \frac{1}{(2n-1)(2n+1)}$ is

- Neither monotone in increasing nor decreasing
- Monotone increasing and bounded
- Monotone increasing and unbounded
- Monotone decreasing and bounded

Question No.50 4.00

Bookmark

The set of all real numbers x such that $||3-x| - |x+2|| = 5$ is

- $(-\infty, -2]$
- $(-\infty, -2] \cup [3, \infty)$
- $(-\infty, -3] \cup [2, \infty)$
- $[3, \infty)$

Question No.51 4.00

Bookmark

Every bounded sequence of real numbers has

- either a convergent or a divergent subsequence
- a convergent subsequence
- neither convergent nor divergent subsequence
- a divergent subsequence

Question No.52 4.00

Bookmark

It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the cars is:

- 1:2
- 3:4
- 2:3
- 1:4

Question No.53 4.00

Bookmark

Any solution of homogeneous Volterra integral equations of the second kind $\phi(x) - \lambda \int_0^x K(x,y)\phi(x)dy = 0$ in L_2-space is

- necessarily a non-zero function
- constant
- necessarily a zero function
- absolute function

Question No.54 4.00

Bookmark

Let E be the set of all numbers in $[0,1]$ such that the decimal representation of x does not contain the digit 7. Then the Lebesgue measure of E is

- 0.9
- 1
- 0.7
- 0

Question No.55 4.00

Bookmark

Based on the given information, answer the following question.
1. Six friends P,Q,R,S,T and U are memebers of a club and play different games of Football, Cricket, Tennis, Basketball, Badminton and Volleyball
2. T who is taller than P and S plays Tennis.
3. The tallest among them plays Basketball.
4. The Shortest among them plays volleyball

4. The Shortest among them plays volleyball.
5. Q and S neither play Volleyball nor Basketball.
6. R plays Volleyball
7. T is between Q who plays Football and P in order of height

What does S Play?

- Cricket
- Badminton
- Either Cricket or Badminton
- None of the above

Question No.56 4.00

Bookmark

For an ideal spring mass arrangement

- The Hamiltonian equation of motion is $\ddot{x} - x = 0$
- The Hamiltonian equation of motion is $\ddot{x} + \frac{k}{m}x = 100$
- The Hamiltonian equation of motion is $\ddot{x} = kx$
- The Hamiltonian equation of motion is $\ddot{x} + \frac{k}{m}x = 0$

Question No.57 4.00

Bookmark

Let $f : [a, b] \longrightarrow \mathbb{R}$ be a continuous function, such that $f(a) < f(b)$. Then

- $f([a, b]) \supseteq [f(a), f(b)]$
- $f([a, b]) \neq [f(a), f(b)]$
- $f([a, b]) \subseteq [f(a), f(b)]$
- $f([a, b]) = [f(a), f(b)]$

Question No.58 4.00

Bookmark

A connected graph G is bipartite if and only if

- G contains no odd cycles
- G contains no even cycles
- G contains even number of vertices
- G contains odd number of vertices

Question No.59 4.00

Bookmark

Based on the information given, answer the below question.
1. A,B,C,D,E and F are travelling in a bus.
2. There are two reporters, two mechanics, one photographer and one writer in the group.
3. Photographer A is married to D who is a reporter.
4. The writer is married to B who is of the same profession as that of F.
5. A,B,C,D are two married couples and no one in this belong to the same profession.
6. F is the brother of C.

How is C related to F?

- Brother
- Brother-in-law
- Sister
- Cannot be determined

Question No.60 4.00

Bookmark

Let $T : \mathbb{R}^3 \longrightarrow \mathbb{R}^3$ be a linear mapping defined by $T(x, y, z) = (0, x, y)$ for $x, y, z \in \mathbb{R}$. Then the kernel of T^2 is equal to

- $\{(x, y, z) : x = 0\}$
- $\{(x, y, z) : x = y = z\}$
- $\{(x, y, z) : y = z = 0\}$
- $\{(x, y, z) : y \neq z\}$

Question No.61 4.00

Bookmark

$\begin{bmatrix} 0 & i \end{bmatrix}$

The matrix $\begin{bmatrix} & \\ -i & 0 \end{bmatrix}$ is a

- skew-Hermitian matrix
- skew-symmetric matrix
- Hermitian matrix
- symmetric matrix

Question No.62 4.00

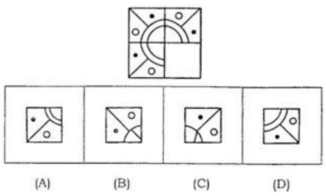
Bookmark

Select the option which improves the underlined part of the sentences.
The Prime Minister called on the President.

- to
- in
- No improvement
- by

Question No.63 4.00

Bookmark



- B
- D
- A
- C

Question No.64 4.00

Bookmark

Identify the underlined part of speech:
Sorry, I don't know any <u>foreign</u> languages

- adverb
- pronoun
- adjective
- noun

Question No.65 4.00

Bookmark

The eigenvalues of a Hermitian matrix are

- rationals
- real
- complex
- purely imaginary

Question No.66 4.00

Bookmark

Let G be a group of order 77. Then the center of G is isomorphic to

- $\mathbb{Z}_{77}$
- $\mathbb{Z}_1$
- $\mathbb{Z}_7$
- $\mathbb{Z}_{11}$

Question No.67 4.00

Bookmark

Let G be a simple group of order 168. Then the number of subgroups of G of order 7 is

- 1
- 8
- 7
- 28

Question No.68 4.00

Bookmark

$lim\ sup$ and $lim\ inf$ of the sequence $x_n = \frac{n}{2} - \left[\frac{n}{2}\right]$ are

- unequal
- 0
- equal
- do not exist

Question No.69 4.00

Bookmark

Let $T : \mathbb{R}^3 \longrightarrow \mathbb{R}^3$ be a linear transformation defined by $T(x, y, z) = (y, 0, z)$ for $x, y, z \in \mathbb{R}$. Then the rank of T is

- 1
- 3
- 0
- 2

Question No.70 4.00

Bookmark

The differential equation $\frac{d^2y}{dx^2} + sin(x + y) = sin\ x$ is

- non-linear and non-homogeneous
- linear and homogeneous
- non-linear and homogeneous
- linear and non-homogeneous

Question No.71 4.00

Bookmark

The functional $\int_0^1 (y'^2 + 4y^2 + 8ye^x)dx$, $y(0) = \frac{-4}{3}$, $y(1) = \frac{-4e}{3}$ possesses:

- strong minima on $y = \frac{-4}{3}e^x$
- strong minima on $y = \frac{-1}{3}e^x$
- strong maxima on $y = \frac{-4}{3}e^x$
- weak maxima on $y = \frac{-1}{3}e^x$

Question No.72 4.00

Bookmark

Choose the best synonym of the italicized word.
Each one of us is the subject of *derision* at some time or the other in our life.

- criticism
- laughter
- ridicule
- irony

Question No.73 4.00

Bookmark

If $y = x$ is a solution of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$, then the second linearly independent solution of the above differential equation is

- x^2
- x^n
- x^{-2}
- 1/x

Question No.74 4.00

Bookmark

If f(z) is an analytic function on z, then

- $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)|Re\ f(z)|^2 = 0$
- $\left(\frac{\partial^2}{\partial x^2}\right)[Re\ f(z)]^2 = 2|f'(z)|^2$
- $\frac{\partial}{\partial x}[Re\ f(z)]^2 = 2|f'(z)|^2$
- $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)|Re\ f(z)|^2 = 2|f'(z)|^2$

Question No.75 4.00

Bookmark

Choose the missing term: 3F,6G,11I,18L, ?

- 27O
- 26N
- 28Q
- 27P

Question No.76 4.00

Bookmark

Any function f(x, y) is called a harmonic function

- If f(x, y) possessing first order partial derivatives
- If f(x, y) satisfies Laplace equation
- If f(x, y) possessing continuous first order partial derivatives and satisfies Laplace equation
- If f(x, y) possessing continuous first and second order partial derivatives

Question No.77 4.00

Bookmark

The kinetic energy for the harmonic oscillator is

- $-\frac{1}{2}mx^2$
- mx
- $\frac{1}{2}mx^2$
- $\frac{1}{-}mx$

$2^{\cdots}$

Question No.78 4.00

Bookmark

Let V be the vector space of all skew-symmetric matrices of order $n \times n$. Then $dim\ V$ is

- n^2
- n
- $\frac{n(n-1)}{2}$
- $\frac{n(n+1)}{2}$

Question No.79 4.00

Bookmark

If $f(x) = \begin{cases} -1; & x < -1 \\ -x; & -1 \le x \le 1 \\ 1; & x > 1 \end{cases}$ is continuous

- At x = 1 but not at x = -1
- At x = -1 but not at x = 1
- At none of x = 1 and x = -1
- At both x = 1 and x = -1

Question No.80 4.00

Bookmark

The closure of the set A = $\{3/2, 4/2, 5/4, 6/5, ...\}$ with respect to usual topology on R is

- $\bar{A} = \{1\}$
- $\bar{A} = \{1, 2, 3/2, 4/2, ...$
- $\bar{A} = \{1, 2, 3, 4, ...\}$
- $\bar{A} = \Phi$

Question No.81 4.00

Bookmark

The connected subsets of the real line with the usual topology are

- only compact intervals
- only bounded intervals
- all intervals
- only semi-infinite intervals

Question No.82 4.00

Bookmark

The differential equation $\frac{dy}{dx} = \sqrt{y}$ with initial condition $y(0) = 0$ has

- a unique solution
- infinitely many solutions
- no solution
- two distinct solutions

Question No.83 4.00

Bookmark

Let W be the subspace of the vector space $\mathbb{R}^3$ generated by $(-3,0,1)$, $(1,2,1)$ and $(3,0,-1)$. Then the dimension of W is

- 2
- 3
- 1
- 0

Question No.84 4.00

Bookmark

Let $B=\{(x,y)\in\mathbb{R}^2 : x\geq 0, y\geq 0\}$. Then B is closed in $\mathbb{R}^2$ with usual topology because

- it is compact
- its complement is open
- it does not contain all its limit points
- it is connected

Question No.85 4.00

Bookmark

Choose the correct meaning of the italicized idiom.
Sheela's work seems to be a *Penelope's web*.

- Declining
- Difficult
- In her best form
- Endless

Question No.86 4.00

Bookmark

Good restaurants serving pure vegetarian food are very hard to ___________.

- come by
- get in
- take to
- go through

Question No.87 4.00

Bookmark

Let S be a non-empty Lebesgue measurable subset of $\mathbb{R}$ such that every subset of S is measurable. Then the measure of S is equal to the measure of any

- bounded subset of S
- subset of S
- countable subset of S
- closed subset of S

Question No.88 4.00

Bookmark

The number of edges in a tree on n vertices is

- n + 1
- n - 1
- n - 2
- n

Question No.89 4.00

Bookmark

Generalized coordinates are

- A set of independent coordinates excesses in number to describe completely the state of configuration of dynamical system
- A set of dependent coordinates excesses in number to describe completely the state of configuration of dynamical system
- A set of independent coordinates sufficient in number to describe completely the state of configuration of dynamical system
- A set of dependent coordinates sufficient in number to describe completely the state of configuration of dynamical system

Question No.90 4.00

Bookmark

The value of the integral $\int\limits_{|z|=4} \frac{dz}{z^2-1}$ is

- πi

- $-\pi i$
- $2\pi i$
- 0

Question No.91 4.00

Bookmark

Which of the following statement is wrong?

- Every separable metric space is second countable
- Every separable space is second countable
- Every second countable space is separable
- Every second countable space is a lindelof space

Question No.92 4.00

Bookmark

Find out the missing term:

1, 2, 3, 6, 11, 20, 37, 68, ?

- 126
- 105
- 124
- 125

Question No.93 4.00

Bookmark

Choose the correct meaning of the italicized idiom.
He had great difficulty to *save his bacon* when he was blackmailed.

- Threaten somebody
- Put bacon in the refrigerator
- Escape death
- Save pork

Question No.94 4.00

Bookmark

Let $\mathbb{R}$ be the field of real numbers and f be an automorphism of $\mathbb{R}$. Then for all $x \in \mathbb{R}$,

- $f(x) = x^2$
- $f(x) = -x$
- $f(x) = -x^2$
- $f(x) = x$

Question No.95 4.00

Bookmark

The differential equation $|\frac{dy}{dx} + |y| = 0, y(0) = 1$ has

- finite number of solutions
- unique solution
- no solution
- infinite number of solutions

Question No.96 4.00

Bookmark

A bead slides on a wire in the shape of a cycloid described by the equations $x = a(\theta - \sin\theta)$, $y = a(1+\cos\theta)$

where $0 \le \theta \le 2\pi$

- The kinetic energy of the bead is $ma^2\,\theta^2$
- The potential energy of the bead is ma^2
- The equation of motion of the bead is $\theta^2(1-\cos\theta)$
- The Lagrangian is $ma^2\,\theta^2(1-\cos\theta) - mga(1+\cos\theta)$

Question No.97 4.00

Bookmark

Choose the best antonym of the italicized word.
Ravi and Raghu are really *obstinate* men.

- friendly
- understanding
- compliant
- considerate

Question No.98 4.00

Bookmark

In the complex plane e^z assumes

- every value
- every positive value
- every value excepting zero
- every negative value

Question No.99 4.00

Bookmark

Let $f(z) = \begin{cases} \frac{|z|}{Re\ z} & \text{Re } z \neq 0; \\ 0 & \text{Re } z = 0. \end{cases}$

Then

- is neither continuous nor differentiable at $z = 0$
- has a non-zero limit as $z \to 0$
- is continuous but not differentiable at $z = 0$
- is differentiable at $z \to 0$

Question No.100 4.00

Bookmark

A metric space is always

- separable
- first countable
- Lindelof
- second countable