Course Code : 1mscm1
Course: Title: Advanced Abstract Algebra
Credit: 4
Last Submision Date : April 30 (For January Session)
October 31, (For July Session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Let H&K be two distinct maximal normal subgroup of G then G = HK and H ∩ K is a maximal normal subgroup of H as well as K.
Que.2 State & prove Jordan – Holder theorem.
Que.3 A subgroup of a solvable group is solvable.
Que.4 Homomorphic image of a nilpotent group is nilpotent.
Que.5 Let K be a finite extension of F and L be a finite extension of K. Then L is a finite extension of F i.e.

$$[L:F] = [L: K] \; [K: F]$$

Que.6 Let $k/_F$ be a finite extension and suppose K is perfect then show that Fis perfect.
Que.7 State & prove Cauchy’s theorem for finite group.
Que.8 State & prove Lagrange’s theorem.
Que.9 If D is an integral domain with unity in which every non- zero, non unit element is a finite product of irreducible element and every irreducible element is prime then D is a unique factorization domain.
Que.10 State & prove Fermat’s theorem.

Course Code : 1MSCM2
Course: Title: Real Analysis-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Show that sequence $\{\frac{2n+3}{3n-2}\}$ is convergent.

Que.2 Prove that $\lim_{n\to\infty}\{\frac{x^n}{n}\}$ =0 if $|x| < 1$

Que.3 Test the convergence of the series

$$x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+ \text{-------}$$

Que.4 Test the convergence or divergence of the series

$$1^p+(\frac{1}{2})^p+(\frac{1.3}{2.4})^p+(\frac{1.3.5}{2.4.6})^p+ \text{-------}$$

Que.5 Suppose g (x) = $\sum_{n=0} c_{nx^n}$ be a power series which converges for $|x| < 1$, If

$\sum_{n=0} c_n$ converges then $\lim_{x\to 1} g(x) = \sum_{n=0} c_n$

Que.6 If $\sum u_n$ is convergent then $\lim_{n\to 0} u_n = 0$

Que.7 State and prove Bolzano – weierstrass theorem.
Que.8 State & prove Baire category theorem for R.
Que.9 State & prove Cauchy' mean value theorem.

Que.10 If f (x ,y) = $\begin{cases} \frac{xy}{x^2+y^2}, & for\ (x,y) \neq (0,0) \\ 0, & for\ (x,y) = (0,0) \end{cases}$

Find $f_x(0,0)$ and $f_y(0,0)$

Course Code : 1MSCM3
Course: Title: Topology-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Prove that intersection of two topologies is also topology but union of two topologies is not necessary a topology.

Que.2 If $\{ f_{\lambda} : \lambda \in \wedge \}$ is anycollection of closed subsets of a topological space $\times$, then $\wedge \{ f_{\lambda} : \lambda \in \wedge \}$ is a closed set.

Que.3 Let $\times$ be a topology space and let A be a subset of $\times$ Then A is closed if and only if D(A) $\subset A$.

Que.4 Let (x, $\mathcal{J}$) be a topological space and let A&B be any subset of x. then

(1) $X^\circ = X$, $\emptyset^\circ = \emptyset$
(2) $A^\circ \subset A$
(3) $A \subset B \Rightarrow A^\circ \subset B^\circ$
(4) $(A \cap B)^\circ = A^\circ \cap B^\circ$
(5) $A^\circ \cup B^\circ$ C $(A \cup B)^\circ$
(6) $A^\circ = A$

Que.5 A mapping f from a space X into another space Y is continuous if and only if f (Â) $\overline{F(A)}$ for every $A \subset X$.

Que.6 Let (X,$\mathcal{J}$) and (Y,V) be topological spaces and let f be a bijective mapping of X to Y. Then the following statement are equivalent then the following statement are equivalent:

(1) f is a homeomorphism.
(2) f is a continuous and open.
(3) f is continuous and closed.

Que.7 Let E be a connected subset of a space X. If F is a subset of X such that $E \subset F \subset$ Ê. Then F is connected. In particular, Ê is connected.

Que.8 Every subspace of T_2–space is a T_2–space .

Que.9 Every compact subset A of a hausdorff space X is closed.

Que.10 If A is an infinite subset of a compact space Y then A has limit point in X. In other words compact space have Bolzano weierstrass property.

Course Code : 1MSCM4
Course: Title: Complex Analysis-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Construct the analytic function f (z) = u + iv of which the real part is

$u = e^x$ (xcosy-ysiny)

Que.2 State & prove Couchy – Riemann Equations.

Que.3 Find the bilinear transformation which maps the points

$Z_1 = 2$, $Z_2 = i$, $Z_3 = -2$ into the

Points $w_1 = 1$, $w_2 = i$ and $w_3 = -1$

Que.4 Let f (z) be an analytic function of z in a domain D of the Z – plane and let f' (z) ≠ 0 inside D . Then the mapping w = f (z) is conformal at all points of D.

Que.5 Let f (z) be a regular (analytic) function and let f'(z) be continues at each point within and on a closed contour c. Then

$$\int_c f(z)dz = 0$$

Que.6 Let f (z) be analytic in the multiply connected region D bounded by the closed contour c and the two interior contours c_1, c_2 then

$$\int_c f(z) = \int_{c_1} f(z) + \int_{c_2} f(z) dz$$

Que.7 State and prove Cauchy integral formula.

Que.8 State and prove Morea's theorem.

Que.9 State & prove Taylor's theorem and also gives example related with it.

Que.10 Let f (z) = $\frac{2z^3+1}{z^2+z}$, then find

(1) a Taylor' s series valid in the neighbourhood of the point z = i
(2) a Laurent's series valid within the annulus of which centre in the origin.

Course Code : 2MSCM1
Course: Title: Advanced Abstract Algebra-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 If f be a homomorphism of R- module M into a R- module N with ker(f) = A then N is isomorphic to M /A i.e. $N \cong M/A$.

Que.2 Arbitrary intersection of sub module is a sub module.

Que.3 If R be Euclidean ring then any finitely generated R- module M is the direct sum of a finite Number of cyclic modules.

Que.4 An irredueible R- module is cyclic.

Que.5 If M is a simple R-module and N is any R –module then

(1) Every non – zero homomorphism f: $M \to N$ is injective.
(2) Every non – zero homomorphism f: $M \to N$ is surjective.
(3) End_R (M) is a division ring , where end $_R$ (M) = $Hom_R(M , M)$

Que.6 Let M be the R- module then following are equivalent :

(1) M is noetherian
(2) Every submodule of M of finitely generated
(3) Every non–empty set S of submodule of M has a maximal element.

Que.7 State & prove Schroeder – bernstion theorem.

Que.8 Wedderburn – Artin theorem.

Que.9 Let M be a noetherian module. Then each non- zero sub module of M contains a uniform modules.

Que.10 State & prove Noether – Laskar theorem.

Course Code : 2MSCM2
Course: Title: Real Analysis-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Let f be a bounded function and $\propto$ be a monotonically increasing function on [a,b]. Then f ϵR ($\propto$) on [a,b] if and only if for every $\in > 0$ there exists a partition p such that

$$U(p,f, \propto) - L(p,f, \propto) < \in$$

Que.2 If $f_1 \in R(\propto)$ and $f_2 \in R(\propto)$ on [a , b] then

$$f_1 + f_2 \in R(\propto) \text{ and } \int_a^b (f_1 + f_2)\, d\propto = \int_a^b f_1 \; d\propto + \int_a^b f_2 \; d\propto$$

Que.3 Let $\propto$ be a monotonically inversing function on [a, b] and $\propto' \in R$ [a , b]. Let f be a bounded real function on [a, b]. Then $f \in R(\propto)$ if and only if $f \propto' \in R$ [a,b]. In that case $\int_a^b f d \propto = \int_a^b f(x) \propto'(x) dx$

Que.4 Let f(x) = x and $\propto(x) = x^2$. Does $\int_0^1 f d \propto$ exist? If it exists, find its value.

Que.5 The sum function of a uniformly convergent series of continuous functions is itself continuous.

Que.6 Suppose $\{ f_n \}$ is a sequence of function, differentiable on [a,b] and such that $\{ f_{n\,(x0)} \}$ converges for some point x_0 on [a,b] . If $\{ f'_n \}$ converges uniformly on [a,b]. Then $\{ f_n \}$ converges uniformly on [a,b] to a function f , and f' (x) = $\lim_{n\to\infty} f'_n$ (x) ($a \leq x \leq b$)

Que.7 State and prove Implicit function theorem.

Que.8 If $f(t) = \int_{-\infty}^{\infty} e^{-x^2}.\cos(xt)dx$

And $g(t) = -\int_{-\infty}^{\infty} xe^{-x^2}.\sin(xt)dx$ for $-\infty < t < \infty$. Then prove that both integrals exist and f is differentiable and f'(t) = g (t)

Que.9 Prove that $\frac{\partial(u,v,w)}{\partial(x,y,z)} \times \frac{\partial(x,y,z)}{\partial(u,v,w)} = 1$ i.e. J J' =1

Que.10 If $u^3 + v^3 = x + y$ And $u^2 + v^2 = x^3 + y^3$. Then show that

$$J(u,v) = \frac{\partial(u,v)}{\partial(x,y)} = \frac{y^2 - x^2}{2uv(u-v)}$$

Course Code : 2MSCM3
Course: Title: Topology-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Let F_1, F_2 be any pair of disjoint closed sets in a normal space X. Then there exist a continuous mapping f : X→[0,1] such that f (x) = 0 for $x \in f_1$ & f(x) =1 for $x \in f_2$
Que.2 State & prove Tietze extension theorem.
Que.3 Prove that every second countable space is first countable and converse not true.
Que.4 Every second countable space is separable.
Que.5 A continuous image of a sequentially compact set is sequentially compact.
Que.6 Every closed subspace of a locally compact space is locally compact.
Que.7 Let (X,d) be a complete metric space and let Y be a subspace of X. Then Y is complete if and only if Y is closed.
Que.8 Every convergent sequence in a metric space is a Cauchy sequence.
Que.9 The product space X×Y is connected if and only if X and Y are connected.
Que.10 State & prove Tychonoff’s theorem.

Course Code : 2MSCM4
Course: Title: Complex Analysis-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Evaluate the residues of

$$\frac{z^3}{(z-1)^4(z-2)(z-3)}$$ at the poles z = 1,2,3

Que.2 If f (z) is analytic within and on a closed contour C except at a finite number of poles and has no zero on C, then

$$\frac{1}{2\pi i}\int_C \frac{f'(z)}{f(z)}\,dz = N-P$$

When N is the number of zeros and p is the number of poles inside c.

Que.3 State & prove Cauchy residue theorem.

Que.4 Prove that $\int_0^{2\pi} \frac{\cos 2\theta}{5+4\cos\theta} = \frac{\pi}{6}$

Que.5 prove that $\int_0^{\infty} \frac{\cos mx}{a^2+x^2}\,dx = \frac{\pi}{29}\, e^{-ma}$

When m ≥ o , a > o

Que.6 If a>o, then prove that

$$\int_0^{\infty} \frac{x \sin x}{x^2+a^2}\,dx = \frac{\pi}{2} e^{-a}$$

Que.7 To find all the bilinear transformation which maps the half plane f (z) ≥ 0 onto the unit circular disc 1w 1 ≤ 1.

Que.8 Show that the transformation $w = \frac{2z+3}{z-4}$ maps the circle $x^2 + y^2 - 4x = 0$ onto the straight line 4u+3=0

Que.9 If f (z) = u + iv is an analytic function and $z = re^{i\theta}$, where u , v, r, θ are all real, then show that the Cauchy – Riemann equations are

$$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$$

Que.10 If $u = (x-1)^3 - 3xy^2 + 3y^2$, determine v so that u+ iv is a regular function of x + i y.

Course Code : 3MSCM1

Course: Title: Functional Analysis-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Let X & Y be Banach spaces & T a continuous linear transformation of X onto Y then T is an open mapping.

Que.2 State & prove Holder's & Minkowshki's inequality.

Que.3 Let H be a separable infinite–dimensional complex Hilbert space. Then H is isometrically isomorphic to l_2.

Que.4 If x(t) , y (t) ϵ $L_P(0,1)$ then x(t) $\neq$ y (t) $\in$ L_P (0,1)

Que.5 State & prove Hahn Banach theorem.

Que.6 State & prove Uniform Boundedness theorem.

Que.7 State & prove Riesz–lemma.

Que.8 State & prove Convexity theorem.

Que.9 Let $\{x_n\}$ be a weakly convergent sequence in a normal space X ; i.e. $x_n \overset{w}{\rightarrow}$ x. Then

(1) Weak limit of the sequence $\{x_n\}$ is unique.
(2) Every subsequence of $\{x_n\}$ converges weakly to x.
(3) The sequence II x_n II is bounded.

Que.10 State & prove Uniform boundedness theorem.

Course Code : 3MSCM2
Course: Title : Integral Transform-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 State & Prove Initial & Final value theorem.

Que.2 Solve the Following by replace transform

1. $e^{-2t}(3\cos 6t - 5\sin 6t)$ 2. $e^{t}\sin^2 t$

3. $t^2 \cos at$ 4. $\frac{\sin at}{t^2}$ 5. $\int_{\circ}^{\infty}\frac{\sin t}{t}\, dl = \frac{\pi}{2}$

Que.3 Solve $\frac{d^4y}{dx^4} + m^4 y = 0$

Que.4 Solve $\frac{d^2y}{dx^2} + a^2 y = \sec(ax)$

Que.5 The initial temperature of a slap of homogenous material bounded by the planes x = 0 and x= L is to find the temperature in this solid after the face x = o is insulated and the temperature of face x = L is reduced to zero.

Que.6 A string is stretched between two fixed points (0,0) and (c,0). If it is displaced into the curve $y = b\sin\left(\frac{\pi x}{c}\right)$ and released from rest in that position at time t = 0, find its displacement at any time t > 0 and any point 0 < x < c.

Que.7 Find the Fourier transform of

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

Que.8 Find the sine and cosine transform of

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

Que.9 Find the finite Fourier sine and cosine transform of f (x) = x

Que.10 Find the finite cosine transform of

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

Course Code : 3MSCM3
Course: Title: Special Functions-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Prove that $\Gamma(z) = \lim_{n\to\infty} \int_0^n \left(1-\frac{t}{n}\right)^n t^{z-1}\, dt$

Que.2 State & prove Gauss multiplication theorem.

Que.3 Prove that if R_e (c-a-b) >o& R_e (c) > R_e(b) >o and c is neither zero nor a negative integer then

$$F(a, b, ; c, 1) = \frac{\Gamma c \quad \Gamma c-a-b}{\Gamma c-a \, \Gamma c-b}$$

Que.4 The complete elliptic integral of first kind being

$$K = \int_0^{1/2\pi} \frac{d\emptyset}{\sqrt{1-k^2 \sin^2\emptyset}} \text{ .Show that } k = \frac{1}{2}\pi\, F\left(\frac{1}{2}, \frac{1}{2} ; 1 ; k^2\right)$$

Que.5 State & prove Whipple's theorem.

Que.6 State & prove Saalschut'z theorem.

Que.7 State & prove Kummer's theorem.

Que.8 State & prove Ramanujan's theorem.

Que.9 Prove that

(1) $\frac{d}{dz}\,[z^n\, J_n(z)] = z^n\, J_{n-1}(z)$

(2) $z\, J_n'(z) = z\, J_{n-1}(Z) - n\, J_n(z)$

Que.10 Prove that

$$J_{\frac{3}{2}}(x) = \sqrt{\left(\frac{2}{\Pi x}\right)} \left[\frac{1}{x} \sin x - \cos x\right]$$

Course Code : 3MSCM4
Course: Title: Advanced Discrete mathematics(Elective-I)
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-Attempt all questions.

Que.1 Consider a set I of integers. Let (I,+,X) be the algebraic system, where + and x are the operation of addition and multiplication on I.

Que.2 Define homomorphism & isomorphism with example.

Que.3 Let (s,∗) and (T, ⊕) be two semigroup and f:S →T be a semigroup homomorphism c then corresponding to f ∃ a congruence relation R on (s,∗) be defined by aRb iff

f(a) = f (b) ∀ a,b ϵ S

Que.4 Let (M,$*, e$) and (T, Δ, e') be two monoids with identifies e and e' if f is an onto mapping from M to T i.e. f: M →T is an isomorphism then f (e) =e'.

Que.5 Let (L, ≤) be a lattice. Then the following results hold:

(A) $For\ \ each\ a\ \in L\ then$

a_1) $a \wedge a = a$

b_2) $a \vee a = a$

(B) $For\ any\ a, b\ , \in L\ then$

b_1) $a \wedge \mathrm{b} = \mathrm{b} \wedge \mathrm{a}$

b_2) $a \vee b = b \vee a$

(C) $For\ any\ a, b, c \in L$

c_1) $(a \wedge \mathrm{b}) \wedge \mathrm{c} = \mathrm{a} \wedge (\mathrm{a} \wedge \mathrm{c})$

c_2) $(a \vee b) \vee c = a \vee (b \vee c)$

(D) $For\ a, b\ \in L\ then$

d_1) $a \wedge (a \vee b) = a$

d_2) $a \vee (a \wedge b) = a$

Que.6 In any lattice (L,∧,∨) the following statement are equivalent:

(1) $a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)\ \forall\ a, b, c \in L$

(2) $a \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)\ \forall\ a, b, c \in L$

Que.7 State & prove Demorgan's low in Boolean algebra.

Que.8 In a Boolean algebra (B,+, . ,') then show that a+b=a+c and ab=ac then b=c

Que.9 A tree T with n-vertices has n-1 edges.

Que.10 To prove that every connected graph has at least one spanning tree.

Course Code : 4MSCM1
Course: Title: Functional Analysis-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 State & prove Closed graph theorem.

Que.2 State & prove Hahn – Banach theorem for linear space.

Que.3 If X is an inner product space and x, y ∈ X. Then

$$|x , y| \leq \|x\| . \|y\|$$

Que.4 Use Cauchy's inequality to prove Schwarz's inequality in the Hilbert space l_2^n.

Que.5 Let $\{e_1, e_2, - - - - -, e_n\}$ be a finite orthonormal set in a Hilbert space H and x be any element to H. Then $\sum_{i=1}^{n} |(x, e_i)|^2 \leq ||x||^2$

Que.6 State & prove Projection theorem.

Que.7 State & prove Riesz Representation theorem for continuous linear function on a Hilbert space.

Que.8 Every Hilbert space H is reflexive.

Que.9 Let T be an operator on H define the adjoint T* of T . the mapping T→ T* of B(H) info itself has the following properties , for $T, T_1, T_2 \in B(H)$ and $\propto \in C$ we have

(1) $(T_1 + T_2)^* = T_1^* + T_2^*$
(2) $(\propto T)^* = \bar{\propto} T^*$
(3) $(T_1 T_2)^* = T_2^* T_1^*$
(4) $T^{**} = (T^*)^* = T$
(5) $\|T^*\| = \|T\|$
(6) $\|T^* T\| = \|T\|^2$

Que.10 If T_1 and T_2 are normal operators on a Hilbert space H with the property that either commutes with the adjoint of the other, then $T_1 + T_2$ and $T_1 T_2$ are normal.

Course Code : 4MSCM2

Course: Title: Integral Transform-II
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-attempt all questions.

Que.1 Using the Fourier sine transform, solve the partial differential equation $\frac{\partial v}{\partial t} = k\frac{\partial^2 v}{\partial x^2}$ for x > 0 , t > 0 , under the boundary conditions V = v 0 when x = 0, t > 0 and the initial condition v = 0, when t= 0 , x > 0 .

Que.2 Use finite Fourier transforms to solve

$$\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$$

U (0 , t) = 0 , U(4 , t) = 0 , U(x , 0) = 2x , where 0< x < 4 , t < (0).

Que.3 Find the Hankel transform of $x^{-2}e^{-x}$ taking $x\,^{J}1$ (px) as the kernel.

Que.4 Find $H^{-1}\{P^{-2}\ e^{-ap}\}$, taking n = 1.

Que.5 State & Prove Parseval's theorem.

Que.6 $Hn\left(\frac{df}{dx}\right) = \int_0^a \frac{df}{dx}$,x Jn (px) dx , where p is the root of the equation $Jn\ (pa) = 0$.

Que.7 Prove that the finite. Hankel transform of f(x) , $0 \leq x \leq 1$ is P^{n-m} Jn (p) , where

$$f\,(x) = \frac{2^{\,1+n-m}}{\sqrt{(m-n}}\ \ (x^n\ (1-x^2)^{m-n-1})$$

Que.8 Find the potential V (r , z) of a field due to a flat circular disc of radius with the centre of the origin and axis along the Z = axis, satisfying the differential equation

$\frac{\partial^2 v}{\partial r^2} + \frac{1}{r}\frac{\partial v}{\partial r} + \frac{\partial^2 v}{\partial z^2} = 0\ ,0\ \leq r < \infty\ ,z \geq\ 0$ and the boundary conditions $v = v(0)$ when $z = 0, 0\ \leq r\ \leq 1$ and $\frac{\partial v}{\partial z}\ = 0$ when $z = 0\ ,\ r > 1$.

Que.9 State & Prove Mellin Inversion theorem.

Que.10 Find M {Sinx}

Course Code : 4MSCM3
Course: Title: Special Functions-I
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-Attempt all questions.

Q.1 Prove that Rodrigues formula for $H_n(x)$

i.e. for $H_n(x) = (-1)^n \, exp\ (x^2) \, \frac{d^n}{dx^n} \{exp\ (-x^2)\}$

Q.2 Prove that $2x\ H_n\ (x) = \ 2_n H_{n-1}\ (x) + H_{n+1}(x)$

Q.3 Prove that

1) $\int_{-\infty}^{\infty} exp\ (-x^2)\ H_n(x)\ H_m(x)dx = 0\ if \quad m \neq n$

2) $\int_{-\infty}^{\infty} exp\ (-x^2)\ H_n(x)\ H_m(x)dx = 2^n . n!. \sqrt{\pi}\ if \quad m = n$

Q.4 Show that

$\int_{-\infty}^{\infty} x^2 \ e^{-x^2}\ \{H_n(x)\ \}^2\ dx = \ \sqrt{\pi}\ .2^n\ .n!\,(n + \frac{1}{2})$

Q.5 Prove that

$(n + 1\ )L_{n+1}(x) = \ (2n + 1 - x)L_n(x) - xL_{n-1}(x)$

Q.6 Prove that

$\int_s^{\infty} e^{-y}\ L_n\ (y)dy = \ e^{-x}\ [L_n\ (x) - L_{n-1}\ (x)]$

Q.7 Show that

$H_{2n}(x) = (-1)^n . 2^{2n}\ .n!\ L_n^{-1/2}\ (x^2\ )$

Q.8 Show that

$L_n^{(\propto)}\ (x) = \frac{x^{-\propto} e^x}{n!} .D^n\ [e^{-x} . x^{n+\propto}]$

Q.9 Prove that

$P_n^{(\propto,\beta\ )}\ (x) = \frac{(x-1)^{-\propto}\,(x+1)^{-\beta}}{2^n.n!}\ D^n\ \left[(x - 1)^{n+\propto}. (x + 1)^{n+\beta}\right]$

Q.10 Prove that

$\int_{-1}^{1}(1 - x)^{\propto}\,(1 + x)^{\beta}\ x^m\ P_n^{(\propto,\beta)}(x)dx = 0$

When m=0 ,1 ,- - - - - - -, (n-1)

Course Code: 4MSCM4

Course: Title: Operation research
Credit: 4
Last Submision Date : April 30 (for January Session)
October 31, (for July session)

Max.Marks:-70
Min.Marks:-25

Note:-Attempt all questions.

Que.1 Solve the following by simplex method

Maximum: $Z=2x_1 + 3x_2$

s.t.c. $x_1 +5x_2 \leq 15$

$2x_1+x_2 \leq 10$

& $x_1 ,x_2 \geq 0$

Que.2 Write the dual of the following L.P.P

Maximum $Z= x_1 + 2x_2 + x_3$

s.t.c. $2x_1 +x_2-x_3\leq 2$

$2x_1 - x_2 + 5x_3 \leq 6$

$4x_1+x_2 + x_3 \leq 6$

& $x_1 , x_2 , x_3 \geq 0$

Que.3 Use dual simplex method to

Maximize $Z= -3x_1 -2x_2$

Subject to $x_1 +x_2 \geq 1$

$x_1+x_2 \leq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \leq 3$

& $x_1 ,x_2 \geq 0$

Que.4 A company manufactures two products , radios and transistors, which must be processed through assembly and finishing department . Assembly has go hours available, finishing can handle up to 72hours of work . Manufacturing one radio requires 6 hours in assembly and 3 hours in finishing . Each transistor requires 3 hours in assembly and 6 hours in finishing if profit is Rs. 120 per radio and Rs. 90 per transistor, determine the best combination of radios and transistors to realize profit of Rs. 2100.

Que.5 Find the optimum solution to the following transportation problem in which the cells contain the transportation cost in rupees.

	W1	W2	W3	W4	W5	Available
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Required	30	30	15	20	5	100 (Total)

Que.6 Five wagons are available at stations 1,2,3,4 & , these are required at five stations

I, II , III IV, V . The mileages between various stations are given by the table below. How should be the wagons be transported so as to minimize the total mileage covered .

	I	II	III	IV	V
1	10	5	9	18	11
2	13	9	6	12	14
3	3	2	4	4	5
4	18	9	12	17	15
5	11	6	14	19	10

Que.7 A project consists of a series of tasks labelled A,B -------, H,I with the following relationships (W<X, Y means X and Y can not start until W is completed ; X,Y<W means W can not start until both X and Y are completed). With this notation construct the network diagram having the following constraints:

A<D, E; B,D<F; C<G; B<H; F,G< I.

Que.8 The time estimates (in weeks) for the activities of a PERT network are given below:

Activity	t_0	t_m	t_p
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

Draw the project network and identify all paths through it.

Que.9 Solve by dynamic programming:

Maximize $Z = 2x_1 + 5x_2$

Subject to $2x_1 + x_2 \leq 430$

$2x_2 \leq 460$

$X_1, X_2 \geq 0$

Que.10 Use dynamic programming to show that $\sum_{i=1}^{n} p_i \,.\log p_i$ subject to the constraint $\sum_{i=1}^{n} p_i = 1$, $p_i \geq 0$ for all i is minimum when $p_1 = p_1$ -------$p_n = \frac{1}{n}$.