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S.Y.B.Sc.(SEM-IV) Paper I –USST401 **SET-1**
All questions are compulsory.
Figures to the right indicate full marks.
Use of calculator is allowed.

Q.1			**Attempt all sub-questions:**	(20)
	a.		**State TRUE or FALSE and correct if necessary. 2 M each**	(10)
		i.	False. Variance = 25/12	
		ii.	False. Mean = ¼	
		iii.	False. If Z is standard Normal variable, then Z^2 follows chi-square distribution.	
		iv.	False. For Normal distribution with parameters (μ= 5,σ^2=100) , μ_7 is 0.	
		v.	True	
	b.		**Answer the following : 2 M each**	(10)
		i.	Variance = 8 / 36 (7) = 2/63	
		ii.	X ~ Normal (μ = 10, σ^2 = 9), Mean deviation about median = $\sqrt{\frac{2}{\pi}}\ \sigma = 0.7979\ \sigma = 3\sqrt{\frac{2}{\pi}} = 2.3937$	
		iii.	If moment generating function (m.g.f.) of r.v. X is $e^{34t+50t^2}$, X ~ Normal (μ = 34, σ^2 = 100)	
		iv.	Variance = 30	
		v.	Mean = 2	
Q.2			**Attempt any TWO sub-questions:**	(20)
	a.		M.G.F. = [e^{bt} - e^{at}] / t (b-a) .....3M μ_r^1 = [b^{r+1} - a^{r+1}] /(b –a) (r +1) ..... 3M Mean = (b+a) /2 ..... 2M Variance = (b –a) ^{2} /12 ..... 2M	(10)
	b.		M.G.F. = (θ /θ – t) ..... 3M C.G.F. = $\log_e$ (θ /θ – t) ..... 3M Mean = 1/θ ..... 2M Variance = 1/θ^2 ..... 2M	(10)
	c.		If X ~ Gamma (b,a) M.G.F. = (1 – t/b) $^{-a}$ ..... 5M Mean = a/b ..... 2M Variance = a/b^2 ..... 3M	(10)
Q.3			**Attempt any TWO sub-questions:**	(20)
	a.		X ~ Normal (μ , σ^2) Mean = E(X) = μ .....5M Variance = $E(X-\mu)^2 = \sigma^2$ 5M	(10)
	b.		X ~ Normal (μ , σ^2)	(10)

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			M.G.F.= Mx(t) = $e^{\mu t+\frac{1}{2}\sigma^2 t^2}$ .....6M X ~ Normal (μ_1,σ_1^2) Y ~ Normal(μ_2,σ_2^2) **Distribution of X+Y** Mx+y(t) = Mx(t) x My(t) = $e^{\mu_1 t+\frac{1}{2}\sigma_1^2 t^2}$ x $e^{\mu_2 t+\frac{1}{2}\sigma_2^2 t^2}$ $= e^{(\mu_1+\mu_2)t+\frac{1}{2}(\sigma_1^2+\sigma_2^2)t^2}$ X+Y ~ Normal ($\mu_1+\mu_2$,$\sigma_1^2+\sigma_2^2$) .....2M **Distribution of X-Y** Mx-y(t) = Mx(t) x My(-t) = $e^{\mu_1 t+\frac{1}{2}\sigma_1^2 t^2}$ x $e^{\mu_2(-t)+\frac{1}{2}\sigma_2^2 t^2}$ $= e^{(\mu_1-\mu_2)t+\frac{1}{2}(\sigma_1^2+\sigma_2^2)t^2}$ X-Y ~ Normal ($\mu_1-\mu_2$,$\sigma_1^2+\sigma_2^2$) 2M	
	c.	i.	X ~ Normal (μ , σ^2) Mode of Normal distribution = μ 5M	(05)
		ii.	p.d.f. of Log Normal distribution with parameters (μ,σ^2) .....2M E(X) = $e^{\mu+\frac{1}{2}\sigma^2}$ 3M	(05)
Q.4			**Attempt any TWO sub-questions:**	**(20)**
	a.		Pdf ..... 1M M.G.F. = (1 – 2t) $^{-n/2}$ ..... 4M C.G.F. .....1M Mean = n ..... 2M Variance = 2n ..... 2M Where n is degrees of freedom	(10)
	b.		$\mu_r^{'} = \mu_{2k}^{'} = [f^k \Gamma (k + ½) \Gamma (f/2 - k)] / \Gamma (1/2) \Gamma (f/2)$ ... 5M $\mu_r^{'} = \mu_{2k+1}^{'} = 0$ .....2M Mean = 0 .....1m Variance = f/f – 2 ..... 2M f : degrees of freedom	(10)
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	c.		$\mu_r^{1} = (f_2/f_1)^r \Gamma (f_1/2 + r) \Gamma(f_2/2 - r)/\Gamma (f_1/2) \Gamma(f_2/2)$ .....7 M Mean = f_2 / f_2 - 2 ..... 3M Where r.v. follows F distribution with (f_1, f_2) degrees of freedom.	(10)
Q.5			**Attempt any TWO sub-questions:**	**(20)**
	a.		X ~ β_I (m,n)	(10)

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			$\mu_r' = \Gamma(m+n)\,\Gamma(m+r)\,/\,\Gamma(m)\,\Gamma(m+n+r)$ ..... 5M Mean $m/m+n$ ..... 2M Variance $= mn/(m+n)^2\,(m+n+1)$ 3M	
	b.	i.	$X \sim$ Normal $(\mu_1=15, \sigma_1^2=16)$ $Y \sim$ Normal $(\mu_2=10, \sigma_2^2=9)$ $2X+Y \sim$ Normal $(\mu=40, \sigma^2=73)$ .....2M $P(2X+Y<40) = 0.5$ 3M	(05)
		ii.	Any **five** properties of Normal distribution with parameters of (μ,σ^2) 5M	(05)
	c.		f(x,y) ..... 3M let $u = x/y$ $v = y$ ..... 1M f(u,v) ..... 2M $f(u) = \int f(u,v)\,dv$ ..... 1M f(u) ..... 2M u ~ beta 1M	(10)
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