COMMON ENTRANCE TEST - 2006

DATE	SUBJECT	TIME
09 - 05 - 2006	MATHEMATICS	2.30 PM to 3.50 PM

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
60	80 MINUTES	70 MINUTES

MENTION YOUR CET NUMBER					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A - 1	58881

IMPORTANT INSTRUCTIONS TO CANDIDATES

(Candidates are advised to read the following instructions carefully, before answering on the OMR answer sheet.)

1. Ensure that you have entered your Name and CET Number on the top portion of the OMR answer sheet.
2. **ENSURE THAT THE BAR CODES, TIMING AND MARKS PRINTED ON THE OMR ANSWER SHEET ARE NOT DAMAGED / MUTILATED / SPOILED.**
3. This Question Booklet is issued to you by the invigilator after the 2nd Bell. i.e., after 2.35 p.m.
4. Enter the Serial Number of this question booklet on the top portion of the OMR answer sheet.
5. Carefully enter the Version Code of this question booklet on the bottom portion of the OMR answer sheet and SHADE the respective circle completely.
6. As answer sheets are designed to suit the Optical Mark Reader (OMR) system, please take special care while filling and shading the Version Code of this question booklet.
7. **DO NOT FORGET TO SIGN ON BOTH TOP AND BOTTOM PORTION OF OMR ANSWER SHEET IN THE SPACE PROVIDED.**
8. Until the 3rd Bell is rung at 2.40 p.m. :
   - Do not remove the staple present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.
9. After the 3rd Bell is rung at 2.40 p.m., remove the staple present on the right hand side of this question booklet and start answering on the bottom portion of the OMR answer sheet.
10. This question booklet contains 60 questions and each question will have four different options / choices.
11. During the subsequent 70 minutes :
    - Read each question carefully.
    - Determine the correct answer from out of the four available options / choices given under each question.
    - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**

CORRECT METHOD OF SHADING THE CIRCLE ON THE OMR SHEET IS AS SHOWN BELOW :

① ② ● ④

12. Please note that even a minute unintended ink dot on the OMR sheet will also be recognised and recorded by the scanner. Therefore, avoid multiple markings of any kind.
13. Use the space provided on each page of the question booklet for Rough work AND do not use the OMR answer sheet for the same.
14. After the last bell is rung at 3.50 p.m., stop writing on the OMR answer sheet.
15. Hand over the OMR ANSWER SHEET to the room invigilator as it is.
16. After separating and retaining the top sheet (CET Cell Copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
17. **Preserve the replica of the OMR answer sheet for a minimum period of One year.**

MATHEMATICS

1. If $A=\{a,b,c\}$, $B=\{b,c,d\}$ and $C=\{a,d,c\}$, then $(A-B)\times(B\cap C)=$

1) $\{(a,c),(a,d),(b,d)\}$
2) $\{(c,a),(d,a)\}$
3) $\{(a,b),(c,d)\}$
4) $\{(a,c),(a,d)\}$

2. The function $f:X\rightarrow Y$ defined by $f(x)=Sin\,x$ is one-one but not onto if X and Y are respectively equal to

1) $\left[\frac{-\pi}{2},\frac{\pi}{2}\right]$ and $[-1,1]$
2) $\left[0,\frac{\pi}{2}\right]$ and $[-1,1]$
3) $[0,\pi]$ and $[0,1]$
4) $\mathbb{R}$ and $\mathbb{R}$

3. If $Log_4^2+Log_4^4+Log_4^{16}+Log_4^x=6$, then $x=$

1) 32
2) 8
3) 4
4) 64

4. If $S_n=\frac{1}{6.11}+\frac{1}{11.16}+\frac{1}{16.21}+\ldots\ldots$ to n terms, then $6S_n=$

1) $\frac{1}{(5n+6)}$
2) $\frac{(2n-1)}{5n+6}$
3) $\frac{n}{(5n+6)}$
4) $\frac{5n-4}{5n+6}$

5. The remainder obtained when $(\underline{|1})^2+(\underline{|2})^2+(\underline{|3})^2+\ldots\ldots+(\underline{|100})^2$ is divided by 10^2 is

1) 14
2) 17
3) 28
4) 27

(Space for Rough Work)

6. If $(p \wedge \sim r) \rightarrow (\sim p \vee q)$ is false, then the truth values of p, q and r are respectively

1) T, F and T
2) F, T and T
3) F, F and T
4) T, F and F

7. If α, β and γ are the roots of the equation $x^3 - 8x + 8 = 0$, then $\sum \alpha^2$ and $\sum \frac{1}{\alpha\beta}$ are respectively =

1) 16 and 0
2) -16 and 0
3) 16 and 8
4) 0 and -16

8. The g.c.d. of 1080 and 675 is

1) 125
2) 225
3) 135
4) 145

9. If $a \mid (b+c)$ and $a \mid (b-c)$ where $a, b, c \in N$ then,

1) $c^2 \equiv a^2 \left(\text{mod } b^2\right)$
2) $a^2 \equiv b^2 \left(\text{mod } c^2\right)$
3) $a^2 + c^2 = b^2$
4) $b^2 \equiv c^2 \left(\text{mod } a^2\right)$

10. If a, b and $c \in N$ which one of the following is not true ?

1) $a \mid b$ and $a \mid c \Rightarrow a \mid b + c$
2) $a \mid b + c \Rightarrow a \mid b$ and $a \mid c$
3) $a \mid b$ and $b \mid c \Rightarrow a \mid c$
4) $a \mid b$ and $a \mid c \Rightarrow a \mid 3b + 2c$

(Space for Rough Work)

11. If $2A+3B=\begin{bmatrix}2 & -1 & 4\\ 3 & 2 & 5\end{bmatrix}$ and $A+2B=\begin{bmatrix}5 & 0 & 3\\ 1 & 6 & 2\end{bmatrix}$, then $B=$

1) $\begin{bmatrix}8 & 1 & 2\\ 1 & 10 & 1\end{bmatrix}$

2) $\begin{bmatrix}8 & 1 & -2\\ -1 & 10 & -1\end{bmatrix}$

3) $\begin{bmatrix}8 & 1 & 2\\ -1 & 10 & -1\end{bmatrix}$

4) $\begin{bmatrix}8 & -1 & 2\\ -1 & 10 & -1\end{bmatrix}$

12. If $O(A)=2\times3$, $O(B)=3\times2$, and $O(C)=3\times3$, which one of the following is not defined ?

1) $C(A+B')$

2) $C(A+B')'$

3) BAC

4) $CB+A'$

13. If $A=\begin{bmatrix}1 & -3\\ 2 & K\end{bmatrix}$ and $A^2-4A+10I=A$, then $K=$

1) 1 or 4

2) 4 and not 1

3) -4

4) 0

14. The value of $\begin{vmatrix}x+y & y+z & z+x\\ x & y & z\\ x-y & y-z & z-x\end{vmatrix}=$

1) 0

2) $(x+y+z)^3$

3) $2(x+y+z)^3$

4) $2(x+y+z)^2$

15. On the set Q of all rational numbers the operation * which is both associative and commutative is given by $a*b=$

1) $2a+3b$

2) $ab+1$

3) a^2+b^2

4) $a+b+ab$

(Space for Rough Work)

16. In the group $G = \{1,5,7,11\}$ under multiplication modulo 12, the solution of $7^{-1} \underset{12}{\times} \left(x \underset{12}{\times} 11\right) = 5$ is $x =$

1) 11
2) 7
3) 1
4) 5

17. A subset of the additive group of real numbers which is not a sub group is

1) $(Q, +)$
2) $(N, +)$
3) $(Z, +)$
4) $(\{0\}, +)$

18. If $\vec{p} = \hat{i} + \hat{j}$, $\vec{q} = 4\hat{k} - \hat{j}$ and $\vec{r} = \hat{i} + \hat{k}$, then the unit vector in the direction of $3\vec{p} + \vec{q} - 2\vec{r}$ is

1) $\hat{i} + 2\hat{j} + 2\hat{k}$
2) $\frac{1}{3}\left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$
3) $\frac{1}{3}\left(\hat{i} - 2\hat{j} - 2\hat{k}\right)$
4) $\frac{1}{3}\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

19. If $\vec{a}$ and $\vec{b}$ are the two vectors such that $\left|\vec{a}\right| = 3\sqrt{3}$, $\left|\vec{b}\right| = 4$ and $\left|\vec{a} + \vec{b}\right| = \sqrt{7}$, then the angle between $\vec{a}$ and $\vec{b}$ is

1) 150^0
2) 30^0
3) 60^0
4) 120^0

20. If $\vec{a}$ is vector perpendicular to both $\vec{b}$ and $\vec{c}$, then

1) $\vec{a} \cdot \left(\vec{b} \times \vec{c}\right) = 0$
2) $\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \vec{0}$
3) $\vec{a} \times \left(\vec{b} + \vec{c}\right) = \vec{0}$
4) $\vec{a} + \left(\vec{b} + \vec{c}\right) = \vec{0}$

(Space for Rough Work)

21. If the area of the parallelogram with $\vec{a}$ and $\vec{b}$ as two adjacent sides is 15 sq. units, then the area of the parallelogram having $3\vec{a}+2\vec{b}$ and $\vec{a}+3\vec{b}$ as two adjacent sides in sq. units is

1) 45
2) 75
3) 105
4) 120

22. The locus of the point which moves such that the ratio of its distances from two fixed points in the plane is always a constant $K(<1)$ is

1) circle
2) straight line
3) ellipse
4) hyperbola

23. If the lines $x+3y-9=0$, $4x+by-2=0$ and $2x-y-4=0$ are concurrent, then $b=$

1) 0
2) 1
3) 5
4) -5

24. The lines represented by $ax^2+2hxy+by^2=0$ are perpendicular to each other if

1) $h=0$
2) $h^2=ab$
3) $a+b=0$
4) $h^2=a+b$

25. The equation of the circle having $x-y-2=0$ and $x-y+2=0$ as two tangents and $x+y=0$ as a diameter is

1) $x^2+y^2=1$
2) $x^2+y^2=2$
3) $x^2+y^2-2x+2y-1=0$
4) $x^2+y^2+2x-2y+1=0$

(Space for Rough Work)

26. If the length of the tangent from any point on the circle $(x-3)^2+(y+2)^2=5r^2$ to the circle $(x-3)^2+(y+2)^2=r^2$ is 16 units, then the area between the two circles in sq. units is

1) 16π
2) 8π
3) 4π
4) 32π

27. The circles $ax^2+ay^2+2g_1x+2f_1y+c_1=0$ and $bx^2+by^2+2g_2x+2f_2y+c_2=0$ $(a \neq 0$ and $b \neq 0)$ cut orthogonally if

1) $g_1g_2+f_1f_2=c_1+c_2$
2) $bg_1g_2+af_1f_2=bc_1+ac_2$
3) $g_1g_2+f_1f_2=bc_1+ac_2$
4) $g_1g_2+f_1f_2=ac_1+bc_2$

28. The equation of the common tangent of the two touching circles, $y^2+x^2-6x-12y+37=0$ and $x^2+y^2-6y+7=0$ is

1) $x+y+5=0$
2) $x+y-5=0$
3) $x-y+5=0$
4) $x-y-5=0$

29. The equation of the parabola with vertex at $(-1, 1)$ and focus $(2, 1)$ is

1) $y^2-2y-12x+13=0$
2) $y^2-2y+12x+11=0$
3) $x^2+2x-12y+13=0$
4) $y^2-2y-12x-11=0$

30. The equation of the line which is tangent to both the circle $x^2+y^2=5$ and the parabola $y^2=40x$ is

1) $2x+y+5=0$
2) $2x-y-5=0$
3) $2x-y+5=0$
4) $2x-y\pm 5=0$

(Space for Rough Work)

31. $x = 4(1+Cos\theta)$ and $y = 3(1+Sin\theta)$ are the parametric equations of

1) $\frac{(x-4)^2}{16}+\frac{(y-3)^2}{9}=1$
2) $\frac{(x-4)^2}{16}-\frac{(y-3)^2}{9}=1$
3) $\frac{(x+4)^2}{16}+\frac{(y+3)^2}{9}=1$
4) $\frac{(x-3)^2}{9}+\frac{(y-4)^2}{16}=1$

32. If the distance between the foci and the distance between the directrices of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ are in the ratio 3 : 2 , then $a : b$ is =

1) 2 : 1
2) 1 : 2
3) $\sqrt{3}:\sqrt{2}$
4) $\sqrt{2}:1$

33. The ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ and the hyperbola $\frac{x^2}{25}-\frac{y^2}{16}=1$ have in common

1) centre and vertices only
2) centre, foci and vertices
3) centre, foci and directrices
4) centre only

34. If $Sec\theta = m$ and $Tan\theta = n$, then $\frac{1}{m}\left[(m+n)+\frac{1}{(m+n)}\right]=$

1) mn
2) $2n$
3) $2m$
4) 2

35. The value of $\frac{Sin\,85^0 - Sin\,15^0}{Cos\,65^0}$ =

1) 0
2) 1
3) -1
4) 2

(Space for Rough Work)

36. From an aeroplane flying, vertically above a horizontal road, the angles of depression of two consecutive stones on the same side of the aeroplane are observed to be 30^0 and 60^0 respectively. The height at which the aeroplane is flying in km is

1) 2
2) $\frac{2}{\sqrt{3}}$
3) $\frac{\sqrt{3}}{2}$
4) $\frac{4}{\sqrt{3}}$

37. If the angles of a triangle are in the ratio 3 : 4 : 5, then the sides are in the ratio

1) 3 : 4 : 5
2) $2 : \sqrt{3} : \sqrt{3}+1$
3) $\sqrt{2} : \sqrt{6} : \sqrt{3}+1$
4) $2 : \sqrt{6} : \sqrt{3}+1$

38. If $Cos^{-1}x = \alpha$, $(0 < x < 1)$ and $Sin^{-1}\left(2x\sqrt{1-x^2}\right) + Sec^{-1}\left(\frac{1}{2x^2-1}\right) = \frac{2\pi}{3}$, then $Tan^{-1}(2x) =$

1) $\frac{\pi}{2}$
2) $\frac{\pi}{3}$
3) $\frac{\pi}{4}$
4) $\frac{\pi}{6}$

39. If $a > b > 0$, then the value of $Tan^{-1}\left(\frac{a}{b}\right) + Tan^{-1}\left(\frac{a+b}{a-b}\right)$ depends on

1) neither a nor b
2) a and not b
3) b and not a
4) both a and b

40. Which one of the following equations has no solution ?

1) $\sqrt{3}\, Sin\,\theta - Cos\,\theta = 2$
2) $Cos\,\theta + Sin\,\theta = \sqrt{2}$
3) $Cosec\ \theta \cdot Sec\ \theta = 1$
4) $Cosec\ \theta - Sec\ \theta = Cosec\ \theta \cdot Sec\ \theta$

(Space for Rough Work)

41. The complex number $\frac{\left(-\sqrt{3}+3i\right)(1-i)}{\left(3+\sqrt{3}i\right)(i)\left(\sqrt{3}+\sqrt{3}i\right)}$ when represented in the Argand diagram lies

1) on the X-axis (Real axis)
2) on the Y-axis (Imaginary axis)
3) in the first quadrant
4) in the second quadrant

42. If $2x=-1+\sqrt{3}i$, then the value of $\left(1-x^2+x\right)^6-\left(1-x+x^2\right)^6=$

1) 0
2) 64
3) -64
4) 32

43. The modulus and amplitude of $\left(1+i\sqrt{3}\right)^8$ are respectively

1) 256 and $\frac{8\pi}{3}$
2) 2 and $\frac{2\pi}{3}$
3) 256 and $\frac{2\pi}{3}$
4) 256 and $\frac{\pi}{3}$

44. The value of $\underset{x \to 0}{Limit} \frac{5^x - 5^{-x}}{2x} =$

1) $2\,Log\,5$
2) 1
3) 0
4) $Log\,5$

45. Which one of the following is not true always ?

1) If a function $f(x)$ is continuous at $x=a$, then $\underset{x \to a}{Limit} f(x)$ exists.
2) If $f(x)$ and $g(x)$ are differentiable at $x=a$, then $f(x)+g(x)$ is also differentiable at $x=a$
3) If $f(x)$ is continuous at $x=a$, then it is differentiable at $x=a$
4) If $f(x)$ is not continuous at $x=a$, then it is not differentiable at $x=a$.

(Space for Rough Work)

46. If $y = 1 + \frac{1}{x} + \frac{1}{x^2} + \frac{1}{x^3} + \ldots\ldots$ to ∞ with $|x| > 1$ then $\frac{dy}{dx} =$

1) $\frac{-y^2}{x^2}$
2) $\frac{y^2}{x^2}$
3) $x^2 y^2$
4) $\frac{x^2}{y^2}$

47. If $f(x)$ and $g(x)$ are two functions with $g(x) = x - \frac{1}{x}$ and $fog(x) = x^3 - \frac{1}{x^3}$, then $f'(x) =$

1) $3x^2 + \frac{3}{x^4}$
2) $1 + \frac{1}{x^2}$
3) $x^2 - \frac{1}{x^2}$
4) $3x^2 - 3$

48. The derivative of $a^{Sec\,x}$ w.r.t. $a^{Tan\,x}$ $(a > 0)$ is

1) $a^{Sec\,x - Tan\,x}$
2) $Sin\,x\ a^{Sec\,x - Tan\,x}$
3) $Sin\,x\ a^{Tan\,x - Sec\,x}$
4) $Sec\,x\ a^{Sec\,x - Tan\,x}$

49. If $Sin(x+y) + Cos(x+y) = Log(x+y)$, then $\frac{d^2y}{dx^2} =$

1) 1
2) -1
3) 0
4) $\frac{-y}{x}$

50. If $f(x)$ is a function such that $f''(x) + f(x) = 0$ and $g(x) = [f(x)]^2 + [f'(x)]^2$ and $g(3) = 8$, then $g(8) =$

1) 8
2) 3
3) 0
4) 5

(Space for Rough Work)

51. If the curve $y = 2x^3 + ax^2 + bx + c$ passes through the origin and the tangents drawn to it at $x = -1$ and $x = 2$ are parallel to the X-axis, then the values of a, b and c are respectively.

1) 3, – 12 and 0
2) – 3, 12 and 0
3) – 3, – 12 and 0
4) 12, – 3 and 0

52. A circular sector of perimeter 60 metre with maximum area is to be constructed. The radius of the circular arc in metre must be

1) 10
2) 15
3) 5
4) 20

53. The tangent and the normal drawn to the curve $y = x^2 - x + 4$ at $P(1, 4)$ cut the X-axis at A and B respectively. If the length of the subtangent drawn to the curve at P is equal to the length of the subnormal, then the area of the triangle PAB in sq. units is

1) 16
2) 8
3) 32
4) 4

54. $\int \frac{\left(x^3 + 3x^2 + 3x + 1\right)}{(x+1)^5} dx =$

1) $Tan^{-1}x + c$
2) $Log(x+1) + c$
3) $\frac{1}{5} Log(x+1) + c$
4) $-\frac{1}{(x+1)} + c$

55. $\int \frac{Cosecx}{Cos^2\left(1 + Log\ Tan\frac{x}{2}\right)} dx =$

1) $-Tan\left[1 + Log\ Tan\ ^{x}/_{2}\right] + c$
2) $Sec^2\left[1 + Log\ Tan\ ^{x}/_{2}\right] + c$
3) $Tan\left[1 + Log\ Tan\ ^{x}/_{2}\right] + c$
4) $Sin^2\left[1 + Log\ Tan\ ^{x}/_{2}\right] + c$

(Space for Rough Work)

56. $\int \frac{dx}{x\sqrt{x^6-16}} =$

1) $Sec^{-1}\left(\frac{x^3}{4}\right)+c$

2) $\frac{1}{12}Sec^{-1}\left(\frac{x^3}{4}\right)+c$

3) $Cosh^{-1}\left(\frac{x^3}{4}\right)+c$

4) $\frac{1}{3}Sec^{-1}\left(\frac{x^3}{4}\right)+c$

57. If $I_1 = \int_0^{\pi/2} x\,Sin\,x\,dx$ and $I_2 = \int_0^{\pi/2} x\,Cos\,x\,dx$, then which one of the following is true ?

1) $I_1 = I_2$

2) $I_1 + I_2 = 0$

3) $I_1 = \frac{\pi}{2} I_2$

4) $I_1 + I_2 = \frac{\pi}{2}$

58. If $f(x)$ is defined in $[-2, 2]$ by $f(x) = 4x^2 - 3x + 1$ and $g(x) = \frac{f(-x)-f(x)}{(x^2+3)}$, then

$\int_{-2}^{2} g(x)dx =$

1) 24

2) 0

3) -48

4) 64

59. The area enclosed between the parabola $y = x^2 - x + 2$ and the line $y = x + 2$ in sq. units =

1) $\frac{4}{3}$

2) $\frac{2}{3}$

3) $\frac{1}{3}$

4) $\frac{8}{3}$

60. The solution of the differential equation $e^{-x}(y+1)\,dy + \left(Cos^2 x - Sin\,2x\right)y\,(dx) = 0$ subjected to the condition that $y = 1$ when $x = 0$ is

1) $(y+1) + e^x Cos^2 x = 2$

2) $y + Log\,y = e^x Cos^2 x$

3) $Log\,(y+1) + e^x Cos^2 x = 1$

4) $y + Log\,y + e^x Cos^2 x = 2$

(Space for Rough Work)

(Space for Rough Work)

A-1