Model Question Paper-I with effect from 2022(CBCS Scheme)

USN | | | | | | | | | |

First Semester B.E Degree Examination

Mathematics-I for Computer Science Engineering Stream (BMATS101)

TIME:03Hours **Max.Marks:100**

Note:

1. Answer any **FIVE** full questions, choosing atleast **ONE** question from each **MODULE**
2. VTU Formula Hand Book is Permitted
3. M: Marks, L: RBT levels, C: Course outcomes.

		Module - 1	M	L	C
Q.1	a	With usual notation prove that $\tan\phi = r\frac{d\theta}{dr}$.	6	L2	CO1
	b	Find the angle between the curves $r = a\log\theta,\ r = \frac{\theta}{\log\theta}$	7	L2	CO1
	c	Show that the radius of curvature at any point of the cycloid $x = a(\theta+\sin\theta),\ y = a(1-\cos\theta)$ is $4a\cos\left(\frac{\theta}{2}\right)$.	7	L3	CO1
		OR			
Q.2	a	Show that the curves $r = a(1+\sin\theta)$ and $r = a(1+\sin\theta)$ cut each other orthogonally.	7	L2	CO1
	b	Find the pedal equation of the curve $\frac{2a}{r} = (1+\cos\theta)$.	8	L2	CO1
	c	Using modern mathematical tool write a program/code to plot the curve $r = 2\lvert cos2\theta\rvert$.	5	L3	CO5
		Module – 2			
Q.3	a	Expand $\log(\sec x)$ by Maclaurin's series up to the term containing x^4.	6	L2	CO1
	b	If $u = e^{(ax+by)}f(ax-by)$, prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$ by using concepts composite functions.	7	L2	CO1
	c	Find the extreme values of the function $f(x,y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$.	7	L3	CO1
		OR			
Q.4	a	Evaluate (i) $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{\frac{1}{x}}$. (ii) $\lim_{x\to 0}\left(\frac{tanx}{x}\right)^{1/x}$.	7	L2	CO1

	b	If $x+y+z=u, y+z=uv, z=uvw$ find $\dfrac{\partial(x,y,z)}{\partial(u,v,w)}$.	8	L2	CO1
	c	Using modern mathematical tool write a program/code to show that $u_{xx}+u_{yy}=0$ $given\ u=e^x(x\cos(y)-y\sin(y))$.	5	L3	CO5
Module – 3					
Q.5	a	Solve: $\frac{dy}{dx}+\frac{y}{x}=x^2y^6$.	6	L2	CO2
	b	Find the orthogonal trajectories of $\frac{x^2}{a^2}+\frac{y^2}{b^2+\lambda}=1$, where λ is a parameter.	7	L3	CO2
	c	Solve $xyp^2-(x^2+y^2)y+xy=0$.	7	L2	CO2
OR					
Q.6	a	Solve $(x^2+y^2+x)dx+xy\,dy=0$	6	L2	CO2
	b	When a switch is closed in a circuit containing a battery E, a resistance R and an inductance L, the current i build up at a rate given by $L\frac{di}{dt}+Ri=E$. Find i as a function of t. How long will it be, before the current has reached one-half its final value, if E = 6 volts, R=100 Ohms and L= 0.1 Henry?	7	L3	CO2
	c	Find the general solution of the equation $(px-y)(py+x)=a^2p$ by reducing into Clairaut's form by taking the substitution $X=x^2$, $Y=y^2$.	7	L2	CO2
Module – 4					
Q.7	a	Find the least positive values of x such that $(i)\ 71\equiv x(mod\ 8)$ $(ii)\ 78+x\equiv 3\ (mod\ 5)$ $(iii)\ 89\equiv(x+3)(mod 4)$	6	L2	CO3
	b	Find the remainder when $(349\times 74\times 36)$ is divided by 3.	7	L2	CO3
	c	Solve: $2x+6y\equiv 1(mod\ 7)\ and\ 4x+2y\equiv 2(mod\ 7)$.	7	L3	CO3
OR					
Q.8	a	(i) Find the last digit of 7^{2013} (ii) Find the last digit of 13^{37}.	6	L2	CO3
	b	Find the remainder when the number 2^{1000} is divided by 13.	7	L3	CO3
	c	Find the remainder when $14!$ is divided by 17.	7	L2	CO3
Module – 5					

Q.9	a	Find the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$	6	L2	CO4
	b	Solve the system of equations by Gauss-Jordan method $x+y+z=10,\ 2x-y+3z=19,\ x+2y+3z=22$.	7	L3	CO4
	c	For what values λ and μ the system of equations $2x+3y+5z=9,\ 7x+3y-2z=8,\ 2x+3y+\lambda z=\mu$, has (i) no solution (ii) a unique solution and (iii)infinite number of solutions.	7	L2	CO4
OR					
Q.10	a	Solve the following system of equations by Gauss – Seidel method $10x+y+z=12,\ x+10y+z=12,\ x+y+10z=12$.	8	L3	CO4
	b	Solve the following system of equations by Gauss-Elimination method $x+y+z=9,\ x-2y+3z=8,\ 2x+y-z=3$.	7	L3	CO4
	c	Using modern mathematical tool write a program/code to find the largest eigen value of $A=\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ by power method.	5	L3	CO5

Model Question Paper-II with effect from 2022 (CBCS Scheme)

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First Semester B.E Degree Examination

Mathematics-I for Computer Science Engineering Stream (BMATS101)

TIME: 03 Hours **Max. Marks: 100**

Note:

1. Answer any **FIVE** full questions, choosing atleast **ONE** question from each **MODULE**
2. VTU Formula Hand Book is Permitted
3. M: Marks, L: RBT levels, C: Course outcomes.

		Module - 1	M	L	C
Q.1	a	With usual notation prove that $\frac{1}{p^2}=\frac{1}{r^2}+\frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$.	6	L2	CO1
	b	Find the angle between the curves $r=\frac{a}{1+\cos\theta}, r=\frac{b}{1-\cos\theta}$.	7	L2	CO1
	c	Find the radius of curvature of the curve $y=x^3(x-a)$ at the point (a, 0).	7	L3	CO1
		OR			
Q.2	a	Show that the curves $r=a(1+\cos\theta)$ *and* $r=a(1-\cos\theta)$ Cut each other orthogonally.	7	L2	CO1
	b	Find the pedal equation of the curve $r(1-\cos\theta)=2a$.	8	L2	CO1
	c	Using modern mathematical tool write a program/code to plot the sine and cosine curve.	5	L3	CO5
		Module – 2			
Q.3	a	Expand $\log(1+\sin x)$ by Maclaurin's series up to the term containing x^4	6	L2	CO1
	b	If $u=\log(\tan x+\tan y+\tan z)$, Show that $\sin 2x\frac{\partial u}{\partial x}+\sin 2y\frac{\partial u}{\partial y}+\sin 2z\frac{\partial u}{\partial z}=2$	7	L2	CO1
	c	Find the extreme values of the function $f(x,y)=x^2+y^2+6x-12$.	7	L3	CO1
		OR			
Q.4	a	If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$ then find the value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$.	7	L2	CO1
	b	If $x=r\sin\theta\cos\phi,\ y=r\sin\theta\sin\phi,\ z=r\cos\theta$ then find $\frac{\partial(x,y,z)}{\partial(r,\theta,\phi)}$.	8	L3	CO1

	c	Using modern mathematical tool write a program/code to evaluate $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$.	5	L3	CO5
		Module – 3			
Q.5	a	Solve $\frac{dy}{dx}+\frac{y}{x}=y^2x$.	6	L2	CO2
	b	Find the orthogonal trajectories of $r = a(1 + \cos\theta)$ where a is parameter.	7	L3	CO2
	c	Solve $p^2+2py\cot x-y^2=0$.	7	L2	CO2
		OR			
Q.6	a	Solve $y(2xy+1)dx-xdy=0$	6	L2	CO2
	b	Find the orthogonal trajectories of the family $r^n\sin n\theta=a^n$.	7	L3	CO2
	c	Find the general and singular solution of the equation $(px-y)(py+x)=a^2p$ reducing into Clairaut's form, using the substitution $X=x^2, Y=y^2$.	7	L2	CO2
		Module – 4			
Q.7	a	(i) Find the remainder when 2^{23} is divided by 47 (ii) Find the last digit in 7^{118}.	6	L2	CO3
	b	Find the solutions of the linear congruence $11x\equiv 4(\text{mod }25)$.	7	L2	CO3
	c	Encrypt the message *STOP* using RSA with key (2537, 13) using the prime numbers 43 and 59.	7	L3	CO3
		OR			
Q.8	a	Using Fermat's Little Theorem, show that $8^{30}-1$ is divided by 31.	6	L2	CO3
	b	Solve the system of linear congruence $x\equiv 3(\text{mod }5),\ y\equiv 2(\text{mod }6),\ z\equiv 4(\text{mod }7)$ using Remainder Theorem.	7	L2	CO3
	c	(i) Find the remainder when 175 × 113 × 53 is divided by 11. (ii) Solve $x^3+5x+1\equiv 0(\text{mod }27)$.	7	L3	CO3
		Module – 5			
Q.9	a	Find the rank of the matrix $\begin{bmatrix}2 & 3 & -1 & -1\\ 1 & -1 & -2 & -4\\ 3 & 1 & 3 & -2\\ 6 & 3 & 0 & -7\end{bmatrix}$	6	L2	CO4
	b	Solve the system of equations by Gauss-Jordan method $x+y+z=9,\ 2x+y-z=0,\ 2x+5y+7z=52$.	7	L3	CO4
	c	Using Rayleigh's power method find the dominant eigenvalue and the corresponding eigenvector of	7	L3	CO4

		$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1\ 0\ 0]^T$ as the initial eigenvector [carry out 6 iterations].			
		OR			
Q.10	**a**	Solve the following system of equation by Gauss-Seidel method: $20x + y - 2z = 17,\ 3x + 20y - z = -18,\ 2x - 3y + 20z = 25$	**8**	**L3**	**CO4**
	b	Solve the system of equations by Gauss elimination method $2x + y + 4z = 12,\ 4x + 11y - z = 33,\ 8x - 3y + 2z = 20$.	**7**	**L3**	**CO4**
	c	Using modern mathematical tool write a program/code to test the consistency of the equations, x+2y-z=1, 2x+y+4z=2, 3x+3y+4z=1.	**5**	**L3**	**CO5**

Model Question Paper –I with effect from 2022

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First Semester B. E Degree examination
Mathematics-I for Computer Science Stream (2MATS11)

Time: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each module.

		Module-1	**Marks**
Q. 01	a	With usual notation prove that $tan\phi = r\frac{d\theta}{dr}$	6
	b	Find the angle between the curves $r = alog\theta$ and $r = \frac{a}{log\theta}$	7
	c	Show that the radius of curvature at any point θ on the cycloid $x = a(\theta + sin\theta), y = a(1 - cos\theta)$ is $4\,a\cos\left(\frac{\theta}{2}\right)$	7
		OR	
Q. 02	a	Show that the curves $r = a(1 + sin\theta)$ and $r = a(1 - sin\theta)$ cuts each other orthogonally	6
	b	Find the pedal equation of the curve $\frac{2a}{r} = (1 + cos\theta)$	7
	c	Find the radius of curvature for the curve $y^2 = \frac{4a^2(2a-x)}{x}$, where the curve meets the x-axis	7
		Module-2	
Q. 03	a	Expand $\log(secx)$ up to the term containing x^4 using Maclaurin's series	6
	b	If $u = e^{ax+by}f(ax - by)$ prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$ by using the concept of composite functions.	7
	c	Find the extreme values of the function $f(x,y) = x^3 + 3xy^2 - 3y^2 - 3x^2 + 4$	7
		OR	
Q. 04	a	Evaluate i) $\lim_{x\to 0}\left(\frac{a^x+b^x}{2}\right)^{1/x}$ ii) $\lim_{x\to 0}\left(\frac{tanx}{x}\right)^{1/x}$	6
	b	If $u = f(x - y, y - z, z - x)$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$	7
	c	If $x + y + z = u,\ \ y + z = v\ and\ z = uvw$, find the values of $\frac{\partial(x,y,z)}{\partial(u,v,w)}$	7
		Module-3	
Q. 05	a	Solve $\frac{dy}{dx} + \frac{y}{x} = x^2y^6$	6
	b	Find the orthogonal trajectories of $\frac{x^2}{a^2} + \frac{y^2}{b^2+\lambda} = 1$, where λ is a parameter.	7

	c	Solve $xyp^2 - (x^2 + y^2)p + xy = 0$	7
		OR	
Q. 06	a	Solve $(x^2 + y^2 + x)dx + xydy = 0$	6
	b	When a switch is closed in a circuit containing a battery E, a resistance R and an inductance L, the current i build up at a rate given by $L\frac{di}{dt} + Ri = E$. Find i as a function of t. How long will it be, before the current has reached one-half its final value, if E = 6 volts, R = 100 ohms and L = 0.1 henry?	7
	c	Find the general solution of the equation $(px - y)(py + x) = a^2p$ by reducing into Clairaut's form by taking the substitution $X = x^2, Y = y^2$	7
		Module-4	
Q. 07	a	Find the least positive values of x such that i) $71 \equiv x(mod 8)$ ii) $78 + x \equiv 3(mod 5)$ iii) $89 \equiv (x + 3)(mod 4)$	6
	b	Find the remainder when $(349 \times 74 \times 36)$ is divided by 3	7
	c	Solve $2x + 6y \equiv 1(mod 7)$ $4x + 3y \equiv 2(mod 7)$	7
		OR	
Q. 08	a	i) Find the last digit of 7^{2013} ii) Find the last digit of 13^{37}	6
	b	Find the remainder when the number 2^{1000} is divided by 13	7
	c	Find the remainder when 14! is divided by 17	7
		Module-5	
Q. 09	a	Find the rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$	6
	b	Solve the system of equations by using the Gauss-Jordan method $x + y + z = 10,\ 2x - y + 3z = 19, x + 2y + 3z = 22$	7
	c	Using power method find the largest eigenvalue and the corresponding eigenvector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$	7
		OR	
Q. 10	a	Solve the following system of equations by Gauss-Seidel method $10x + y + z = 12, x + 10y + z = 12, x + y + 10z = 12$	6
	b	For what values of a and b the system of equation $x + y + z = 6: x + 2y + 3z = 10: x + 2y + az = b$ has i) no solution ii) a unique solution and iii) infinite number of solution	7

	c	Solve the system of equations by Gauss elimination method $x + y + z = 9, x - 2y + 3z = 8, 2x + y - z = 3$	7

Table showing the Blooms Taxonomy Level, Course outcome and Program outcome				
Question		Blooms taxonomy level attached	Course outcome	Program outcome
Q.1	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 2	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 3	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 03
Q. 4	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 02
Q. 5	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 6	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 7	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 8	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 9	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 01
	c)	L3	CO 05	PO 02
Q. 10	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 02
	c)	L3	CO 05	PO 01

Bloom's Taxonomy Levels	**Lower-order thinking skills**		
	Remembering (Knowledge): L_1	Understanding (Comprehension): L_2	Applying (Application): L_3
	Higher-order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6

Model Question Paper –II with effect from 2022

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First Semester B. E Degree examination

Mathematics-1 for Computer Science Stream (22MATS11)

Time: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each module.

		Module-1	**Marks**
Q. 01	a	With usual notation prove that $\frac{1}{p^2}=\frac{1}{r^2}+\frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$	6
	b	Find the angle between the curves $r=\frac{a}{1+cos\theta}$ and $r=\frac{b}{1-cos\theta}$	7
	c	Find the radius of curvature of the curve $y=x^3(x-a)$ at the point $(a,0)$	7
		OR	
Q. 02	a	Show that the curves $r=a(1+\cos\theta)$ and $r=a(1-\cos\theta)$ cuts each other orthogonally	6
	b	Find the pedal equation of the curve $r(1-cos\theta)=2a$	7
	c	Find the radius of curvature for the curve $y^2=\frac{a^2(a-x)}{x}$, where the curve meets the x-axis.	7
		Module-2	
Q. 03	a	Expand $\log(1+sinx)$ up to the term containing x^4 using Maclaurin's series.	6
	b	If $u=\log(tanx+tany+tanz)$ show that $sin2x\frac{\partial u}{\partial x}+sin2y\frac{\partial u}{\partial y}+sin2z\frac{\partial u}{\partial z}=2$.	7
	c	Find the extreme values of the function $f(x,\ y)=x^2+y^2+6x-12$.	7
		OR	
Q. 04	a	Evaluate $\lim_{x\to 0}\left(\frac{a^x+b^x+c^x}{3}\right)^{1/x}$	6
	b	If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$	7
	c	If $x=rsin\theta cos\varphi,\ y=rsin\theta sin\varphi,\ z=rcos\theta$ find the value of $\frac{\partial(x,y,z)}{\partial(r,\theta,\varphi)}$.	7
		Module-3	
Q. 05	a	Solve $\frac{dy}{dx}+\frac{y}{x}=y^2x$	6
	b	Find the orthogonal trajectories of $r=a(1+cos\theta)$ where a is parameter.	7
	c	Solve $p^2+2pycotx-y^2=0$.	7
		OR	

Q. 06	a	Solve $y(2xy+1)dx - xdy = 0$	6
	b	Find the orthogonal trajectories of the family $r^n sin n\theta = a^n$.	7
	c	Find the general solution of the equation $(px-y)(py+x) = 2p$ by reducing into Clairaut's form by taking the substitution $X = x^2,\ Y = y^2$	7
		Module-4	
Q. 07	a	(i) Find the remainder when 2^{23} is divided by 47. (ii) Find the last digit in 7^{118}.	6
	b	Find the solutions of the linear congruence $11x \equiv 4 \pmod{25}$.	7
	c	Encrypt the message **STOP** using RSA with key (2537, 13) using the prime numbers 43 and 59.	7
		OR	
Q. 08	a	Using Fermat's Little Theorem, show that $8^{30} - 1$ is divisible by 31.	6
	b	Solve the system of linear congruence $x \equiv 3(mod 5),\quad y \equiv 2(mod 6),\quad z \equiv 4(mod 7)$ using Remainder Theorem.	7
	c	(i) Find the remainder when $175 \times 113 \times 53$ is divided by 11. (ii) Solve $x^3 + 5x + 1 \equiv 0(mod 27)$.	7
		Module-5	
Q. 09	a	Find the rank of the matrix $\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$	6
	b	Solve the system of equations by using Gauss-Jordan method: $x + y + z = 9$ $2x + y - z = 0$ $2x + 5y + 7z = 52$	7
	c	Using power method, find the largest eigenvalue and corresponding eigenvector of the matrix A = $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$	7
		OR	
Q. 10	a	Solve the following system of equation by Gauss-Seidel method: $20x + y - 2z = 17$ $3x + 20y - z = -18$ $2x - 3y + 20z = 25$	6
	b	Test for consistency $x - 2y + 3z = 2$, $3x - y + 4z = 4$, $2x + y - 2z = 5$ and hence solve	7
	c	Solve the system of equations by Gauss elimination method $2x + y + 4z = 12,\ 4x + 11y - z = 33, 8x - 3y + 2z = 20$	7

Table showing the Blooms Taxonomy Level, Course outcome and Program outcome				
Question		Blooms Taxonomy level attached	Course outcome	Program outcome
Q.1	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 2	a)	L1	CO 01	PO 01
	b)	L2	CO 01	PO 01
	c)	L3	CO 01	PO 02
Q. 3	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 03
Q. 4	a)	L2	CO 02	PO 01
	b)	L2	CO 02	PO 01
	c)	L3	CO 02	PO 02
Q. 5	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 6	a)	L2	CO 03	PO 02
	b)	L3	CO 03	PO 03
	c)	L2	CO 03	PO 01
Q. 7	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 8	a)	L2	CO 04	PO 01
	b)	L2	CO 04	PO 01
	c)	L2	CO 04	PO 02
Q. 9	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 01
	c)	L3	CO 05	PO 02
Q. 10	a)	L2	CO 05	PO 01
	b)	L3	CO 05	PO 02
	c)	L3	CO 05	PO 01

Bloom's Taxonomy Levels	**Lower order thinking skills**		
	Remembering (knowledge): L_1	Understanding (Comprehension): L_2	Applying (Application): L_3
	Higher-order thinking skills		
	Analyzing (Analysis): L_4	Valuating (Evaluation): L_5	Creating (Synthesis): L_6