Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title: **ENGINEERING MATHEMATICS – I**	Course Code : **15SC01M**
Semester : **I**	Core / Elective : **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Type of course : **Lecture + Assignments**	Total Contact Hours : **52**
CIE : **25 Marks**	SEE : **100 Marks**
Programmes: **Common to all Engineering Diploma Programmes**	

Pre-requisites:

Basics in Algebra, Trigonometry and Coordinate Geometry in Secondary Education.

Course Objectives:

1. Apply the concept of matrices and determinants and their applications to solve the linear equation in engineering field.
2. Apply the vector algebra in solving the problems of statics and mechanics.
3. Analyse the civil engineering problems using concepts of probability.
4. Evaluate the advanced engineering mathematical problems using logarithms.
5. Apply and evaluate trigonometric concept in vector engineering field.
6. Create the basic concept of calculus.

Course Content:

Topic and Contents	Hours	Marks
LINEAR ALGEBRA		
UNIT-1: MATRICES AND DETERMINANTS	10	31
(a) Matrices: Basic concepts of matrices: Definition, types of matrices and mathematical operations on matrices (addition, subtraction and multiplication of matrices).	02	
(b) Determinant: Definition, problems on finding the determinant value of 2^{nd} and 3^{rd} order. Problems on finding unknown quantity in a 2^{nd} and 3^{rd} order determinants using expansion. Solving simultaneous linear equations using determinant method (Cramer's rule up to 3^{rd} order).	04	

(c) **Inverse and applications of matrices:** Minors and Cofactors of elements of matrix. Adjoint and Inverse of matrices of order 2^{nd} and 3^{rd} order. Elementary row and column operations on matrices. Characteristic equation and characteristic roots (eigen values) of 2x2 matrix. Statement of Cayley-Hamilton theorem and its verification for 2x2 matrix. Solution of system of linear equations using Gauss Elimination method (for 3 unknowns only).	04	
ALGEBRA		
UNITS-2: VECTORS	08	27
Definition of vector. Representation of vector as a directed line segment. Magnitude of a vector. Types of vectors. Position vector. Expression of vector by means of position vectors. Addition and subtraction of vectors in terms of line segment. Vector in plane and vector in a space in terms of unit vector i, j and k respectively. Product of vectors. Scalar product and vector product of two vectors. Geometrical meaning of scalar and vector product. Applications of dot (scalar) and cross (vector) products. Projection of a vector on another vector. Area of parallelogram and area of triangle. Work done by force and moment of force.		
UNITS-3: PROBABILITY AND LOGARITHMS	08	14
(a) **Probability:** Introduction. Random experiments: outcomes and sample space. Event: Definition, occurrence of an event, types of events. Algebra of events- complementary event, the events A or B, A and B, A but not B, mutually exclusive events, exhaustive events, defining probability of an event. Addition rule of probability. Conditional probability: definition, properties of conditional probability, simple problems.	06	
(b) **Logarithms:** Definition of common and natural logarithms. Laws of logarithms (no proof). Simple problems on laws of logarithms.	02	

TRIGONOMETRY		
UNIT-4: ALLIED ANGLES AND COMPOUND ANGLES.	16	47
(a) Recapitulation of angle measurement, trigonometric ratios and standard angles. **Allied angles:** Meaning of allied angle. Signs of trigonometric ratios. Trigonometric ratios of allied angles in terms of θ. Problems on allied angles. (b) **Compound angles:** Geometrical proof of sin(A+B) and cos(A+B) and hence deduce tan(A+B). Write the formulae for sin(A-B), cos(A-B) and tan(A-B), problems. Multiple and sub multiple angle formulae for 2A and 3A. Simple problems. Transformation formulae. Expression for sum or difference of sine and cosine of angles into product form. Expression for product of sine and cosine of angles into sum or differences form.	02 06 08	
UNIT-5:COMPLEX NUMBERS	04	09
Meaning of imaginary number i and its value. Definition of complex number in the form of $a + ib$. Argand diagram of complex number $a + ib$ (Cartesian system). Equality of complex numbers. Conjugate of complex number. Algebra of complex numbers, modulus of complex number, principal value of argument of complex number, polar form: $Z = r(cos\theta + i\ sin\theta)$ and exponential form $Z = re^{i\theta}$ of complex number, where r is modulus and θ is principal value of argument of complex number.		
UNIT-6: INTRODUCTION TO CALCULUS	06	17
Limits: Constants and variables. Definition of function. Types of functions: Explicit and implicit function, odd and even functions(definition with example). Concept of $x \to a$.Definition of limit of a function. Indeterminate forms. Evaluation of limit of functions by factorization, rationalization. Algebraic limits. Statement of $\lim\limits_{x\to a}\frac{x^n-a^n}{x-a} = na^{n-1}$ where n is any rational number. Proof of $\lim\limits_{\theta\to 0}\frac{\sin\theta}{\theta} = 1$ where θ is in radian. Related problems. Standard limit (statement only) 1. $\lim\limits_{x\to 0}\frac{a^x-1}{x} = \log_e a$, 2. $\lim\limits_{x\to 0}\frac{e^x-1}{x} = 1$ 3. $\lim\limits_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e$, 4. $\lim\limits_{n\to 0}(1+n)^{\frac{1}{n}} = e$ Simple problems on standard limits.		
TOTAL	**52**	**145**

Course outcomes:

On successful completion of the course, the student will be able to:

1. Find the product of matrices, value of determinants, and inverse of matrix and solve the simultaneous linear equation.
2. Find the product of vectors and their geometrical applications in finding moment of force, work done.
3. Determine probability of various types of events.
4. Solve the problems related to logarithms.
5. Solve the problems on trigonometric functions with angle of any magnitude.
6. Evaluate the limiting value of algebraic and trigonometric functions.

Mapping Course Outcomes with Program Outcomes:

CO	Course Outcome	PO Mapped	Cognitive Level	Theory Sessions	Allotted marks on cognitive levels			TOTAL
					R	U	A	
CO1	Find the product of matrices, value of determinants, and inverse of matrix and solve the simultaneous linear equation	**1,2,3**	**R/U/A**	**10**	**9**	**10**	**12**	**31**
CO2	Find the product of vectors and their geometrical applications in finding moment of force, work done	**1,2,3**	**R/U/A**	**8**	**6**	**15**	**6**	**27**
CO3	Determine probability of various types of events	**1,2,**	**R/U/A**	**8**	**3**	**5**	**6**	**14**
CO4	Evaluate the integrations of algebraic, trigonometric and exponential function	**1,2,3,10**	**R/U/A**	**16**	**15**	**20**	**12**	**47**
CO5	Solve the problems related to logarithms.	**1,2**	**R/A**	**4**	**3**	**0**	**6**	**09**
CO6	Evaluate the limiting value of algebraic and trigonometric functions	**1,2,10**	**R/U/A**	**6**	**6**	**5**	**6**	**17**
		Total Hours of instruction		52	**Total marks**			145

R-Remember; U-Understanding; A-Application

Course outcomes –Program outcomes mapping strength

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Engineering Mathematics-I	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq$40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Reference:

1. NCERT Mathematics Text books of class XI and XII.
2. Karnataka State PUC mathematics Text Books of I & II PUC by H.K. Dass and Dr.Ramaverma published by S.Chand & Co.Pvt.Ltd.
3. CBSE Class Xi & XII by Khattar&Khattar published PHI Learning Pvt. ltd.,
4. First and Second PUC mathematics Text Books of different authors.
5. www.freebookcentre.net/mathematics/introductory-mathematics -books.html

Course Assessment and Evaluation:

The Course will be delivered through lectures, class room interaction, exercises and self-study cases.

<table>
<tr><th>Method</th><th colspan="2">What</th><th>To whom</th><th>When/where (Frequency in the course)</th><th>Max Marks</th><th>Evidence collected</th><th>Contributing to course outcomes</th></tr>
<tr><td rowspan="4">DIRECT ASSMENT</td><td rowspan="3">*CIE</td><td>Internal Assessment Tests</td><td rowspan="4">Student</td><td>Three tests (Average of Three tests will be computed).</td><td>20</td><td>Blue books</td><td>1 to 6</td></tr>
<tr><td rowspan="2">Assignments</td><td>Two Assignments based on CO's (Average marks of Two Assignments shall be rounded off to the next higher digit.)</td><td>5</td><td>Log of record</td><td>1 to 6</td></tr>
<tr><td>Total</td><td>25</td><td></td><td></td></tr>
<tr><td>*SEE</td><td>Semester End Examination</td><td>End of the course</td><td>100</td><td>Answer scripts at BTE</td><td>1 to 6</td></tr>
<tr><td rowspan="2">INDIRECT ASSESSMENT</td><td colspan="2">Student feedback</td><td rowspan="2">Students</td><td>Middle of the course</td><td rowspan="2">-NA-</td><td>Feedback forms</td><td>1 to 3, delivery of the course</td></tr>
<tr><td colspan="2">End of Course survey</td><td>End of course</td><td>Questionnaire</td><td>1 to 6, Effectiveness of delivery of instructions and assessment methods</td></tr>
</table>

***CIE** – Continuous Internal Evaluation   ***SEE** – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Composition of Educational Components:

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)
1	Remembering	25
2	Understanding	40
3	Applying the knowledge acquired from the course	30
	Analysis and Evaluation	5

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM	ENGINEERING MATHEMATICS –I	20
	Year:	Course code: **15SC01M**	
Name of Course coordinator :			Units:__ CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Model Question Paper:

Code: 15SC01M

I Semester Diploma Examination

ENGINEERING MATHEMATICS –I

(Common to All Engineering Diploma Programmes)

Time: 3 Hours.][Max marks: 100

Note:

(i) Answer any **Ten** questions from **section-A,** any **Eight** questions from **section-B** and any **Five** questions from **section-C.**

(ii) Each question carries **3** marks in **section-A**.

(iii) Each question carries **5** marks in **section-B**.

(iv) Each question carries **6** marks in **section-C**.

SECTION – A

1. Find the product of $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -1 \\ 5 \end{bmatrix}$
2. If $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 1 \\ 0 & -3 \end{bmatrix}$ find adj(AB).
3. If $A + B = \begin{bmatrix} 3 & -7 \\ 0 & 2 \end{bmatrix}$,$A - B = \begin{bmatrix} 1 & 5 \\ 4 & -6 \end{bmatrix}$ find A.
4. If $\vec{a} = i + 2j - 3k$, $\vec{b} = 3i - 5j + 2k$. Find the magnitude of $2\vec{a} + 3\vec{b}$.
5. If $\vec{A}$=(3,-4), $\vec{B}$= (-5,6) find position vector of A and B and also find $\left|\overrightarrow{AB}\right|$
6. Three coins are tossed simultaneously. List the sample space for event.
7. If $\sin\theta = -{}^{8}/_{17}$ and $\pi < \theta < \frac{3\pi}{2}$ find the value of$4tan\theta + 3sec\theta$.
8. Find the value of $\sin 75^{o}$ using standard angles.
9. Show that $\frac{cosec(180-A)\cos(-A)}{\sec(180+A)\cos(90+A)} = cot^2A$
10. Prove that$\sin(A + B)\sin(A - B) = \sin^2 A - \sin^2 B$.
11. Prove that$\frac{\sin 3A}{\sin A} - \frac{\cos 3A}{\cos A} = 2$.
12. Express the product $(1 + i)(1 + 2i)$ in $a + ib$ form and hence find its modulus.
13. Evaluate : $\lim_{x\to 3}\left[\frac{x-1}{2x^2-7x+5}\right]$
14. Evaluate: $\lim_{x\to\infty}\left[\frac{3x^2+4x+7}{4x^2+7x-1}\right]$

SECTION – B

1. Find the value of x if $\begin{vmatrix} 1 & x & 0 \\ 2 & -1 & 3 \\ -2 & 1 & 4 \end{vmatrix} = 0$.

2. Find the characteristic equation and its roots of a square matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$
3. Find the *sine* of the angle between the vectors$2i - j + 3k$ *and* $i - 2j + 2k$.
4. If vector $\vec{a} = i + j + 2k, \vec{b} = 2i - j + k$ show that $\vec{a} + \vec{b}$perpendicular$\vec{a} - \vec{b}$.
5. Find the projection of $\vec{a} = 2i + j - k$on $\vec{b} = 2i - 3i + 4k$.
6. Prove that $\frac{1}{\log_a abc} + \frac{1}{\log_b abc} + \frac{1}{\log_c abc} = 1$
7. Find the numerical value of$\sin\left(\frac{\pi}{3}\right).\cos\left(-\frac{\pi}{3}\right) - \cos\left(\frac{\pi}{4}\right).\sin\left(-\frac{3\pi}{4}\right)$
8. Prove that $\sin(A + B) = \sin A \cos B + \cos A \sin B$ geometrically
9. If$A + B + C = \frac{\pi}{2}$, prove that $\tan A \tan B + \tan B \tan C + \tan C \tan A = 1$.
10. Show that$\frac{\sin 56^o - \sin 44^o}{\cos 56^o + \cos 44^o} = \cot 82^o$
11. Evaluate:$\lim_{x\to 0}\left[\frac{\sqrt{1+x+x^2}-1}{x}\right]$

SECTION – C

1. Solve for x, y & z using determinant method

$x + y = 0, y + z = 1 \& z + x = 3.$

2. Solve the equation$x + y + z = 6$, $2x - 3y + z = 1 \& x + 3y - 2z = 7$ using Gauss elimination method.
3. A force $\vec{F} = 2i + j + k$ is acting at the point (-3,2,1). Find the magnitude of the moment of force $\vec{F}$ about the point (2,1,2).
4. A die is thrown twice and the sum of the numbers appearing is absorbed tobe. What is the conditional probability that the number 5 has appeared at least once?
5. Prove that $\frac{\cos\left(\frac{5\pi}{2}-\theta\right)}{\sin(4\pi+\theta)} + \frac{\tan(-\theta)}{\cot(\pi-\theta)} = sec^2\theta$
6. Prove that $\cos 80^o \cos 60^o \cos 40^o \cos 20^o = \frac{1}{16}$
7. Find the modulus and argument of the complex number $z = -\sqrt{3} + i$ and hence represent in argand diagram.
8. Prove that $\lim_{\theta\to 0}\left(\frac{\sin\theta}{\theta}\right) = 1$ where θ is in radian.

Question Paper Blue Print:

Course: **ENGINEERING MATHEMATICS – I** **Course Code:** **15SC01M**

UNIT NO		HOURS	Each questions to be set for 3 Marks Section - A	Each questions to be set for 5 Marks Section - B	Each questions to be set for 6 Marks Section- C	Weightage of Marks
1	**a**	**2**	2	-	-	31
	b	**4**	-	1	1	
	c	**4**	1	1	1	
2		**8**	2	3	1	27
3	**a**	**6**	1	-	1	14
	b	**2**	-	1	-	
4	**a**	**8**	1	1	1	47
	b	**8**	4	3	1	
5		**4**	1	-	1	9
6		**6**	2	1	1	17
TOTAL		**52**	**14**	**11**	**08**	**145**
Questions to be answered			**10**	**08**	**05**	**100**

Guidelines for Question Paper Setting:

1. The question paper must be prepared based on the blue print without changing the weigh age of model fixed for each unit.
2. The question paper pattern provided should be adhered to
   Section-A: 10 questions to be answered out of 14 questions each carrying 03 marks
   Section-B: 08 questions to be answered out of 11 questions each carrying 05 marks.
   Section-C: 05 questions to be answered out of 08 questions each carrying 06 marks.
3. Questions should not be set from the recapitulation topics.
4. Questions should not be set from the recapitulation topics.

Model Question Bank:

Course Title: **ENGINEERING MATHEMATICS – I**	Course Code: **15SC01M**

UNIT-1: MATRICES AND DETERMINANTS

3 MARK QUESTIONS

1. If $A = \begin{bmatrix} 3 & -9 \\ -4 & 7 \end{bmatrix}$, find $A + A'$.
2. If $A = \begin{bmatrix} 2 & -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & -2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, find AB matrix.
3. If matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ 5 & 1 & 0 \\ 1 & 0 & x \end{bmatrix}$ is a singular matrix, then find the value of x.
4. Find the adjoint of the matrix $A = \begin{bmatrix} 4 & -5 \\ 3 & -2 \end{bmatrix}$.
5. If $A = \begin{bmatrix} 3 & -1 \\ 0 & -2 \end{bmatrix}$ find the characteristic equation.

5 MARK QUESTIONS

1. Solve the equations $x + y = 3, 2x + 3y = 8$ by Cramer's rule.
2. Solve for x, if $\begin{vmatrix} 1 & 5 & 7 \\ 2 & x & 14 \\ 3 & 1 & 2 \end{vmatrix} = 0$
3. Verify Cayley-Hamilton theorem if $A = \begin{bmatrix} 1 & 3 \\ 2 & -4 \end{bmatrix}$.
4. Verify $A(\mathrm{Adj}A) = |A|.I.$ if $A = \begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$.
5. Find the adjoint of the matrix $A = \begin{bmatrix} 3 & -1 & 2 \\ 2 & -3 & 1 \\ 0 & 4 & 2 \end{bmatrix}$

6 MARK QUESTIONS

1. Solve for x &y from the equations $4x + y = 7, 3y + 4z = 5, 5x + 3z = 2$ by Cramer's rule.
2. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$
3. Prove that adj(AB)=(adjB).(adjA) if $A = \begin{bmatrix} -1 & 0 \\ 5 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$

4. Find the characteristic roots of a matrix $\begin{bmatrix} 1 & -1 \\ -6 & -2 \end{bmatrix}$.
5. Solve the equations by Gauss elimination method $3x - y + z = 0, x + 2y - 2z = 3, 3x + z = 4$.

UNIT-2: VECTORS

3 MARK QUESTIONS

1. Find the magnitude of vector 2i +3j – 6k
2. If $\vec{a} = i + 2j - 3k, \vec{b} = 3i - 5j + 2k$ find magnitude of $\overrightarrow{3a} - \overrightarrow{2b}$
3. Show that $\cos\theta i - \sin\theta j$ is unit vector
4. Show that the vectors $2i + 5j - 6k$,and $7i + 2j + 4k$ orthogonal vectors.
5. If $\vec{a} = 5i + 2j - 4k$, and $\vec{b} = 2i - 5j + 3k$find $\vec{a}X\vec{b}$.

5 MARK QUESTIONS

1. Find cosine of the angle between the vectors $4i - 2j - 3k$and $2i - 3j + 4k$.
2. Find the projection of $\vec{b}$ on $\vec{a}$ if $\vec{a} = 5i + 2j - 4k$and $\vec{b} = 2i - 5j + 6k$.
3. If $\vec{a} = 3i + 2j - 4k$ and $\vec{b} = i - 2j + 5k$ are two sides of a triangle, find its area.
4. Simplify $(\vec{a} + \vec{b}).(\vec{a} - \vec{b})$and $(\vec{a} + \vec{b})X(\vec{a} - \vec{b})$.
5. Find the magnitude of moment of force $4i - 2j + 5k$ about (2,5,-7) acting at (4,7,0)

6 MARK QUESTIONS

1. If A=(2,5,7), B=(3,9,4) and C=(-2,5,7) are three vertices of parallelogram find its area.
2. If a force $4i + 6j + 2k$ acting on a body displaces it from (2,7,-8) to (3,9,4). Find the work done by the force.
3. Find the sine of the angle between the vectors $4i - 2j - 3k$and $2i - 3j + 4k$.
4. Find the unit vector in the direction perpendicular to both vector $2i - 5j + k$and $5i + j + 7k$.
5. Show that the points whose position vectors are $i - 3j - 5k$, $2i - j + k$ and $3i - 4j - 4k$ form a right angled triangle.

UNIT-3: PROBABILITY AND LOGARITHMS

3 MARK QUESTIONS

1. Define equally likely events, Independent event, and mutually exclusive event.
2. Define probability of an event.
3. A coin is tossed twice. What is the probability that at least one head occurs.
4. A die is thrown once, what is the probability an odd number appears.
5. If E and F are events such that P(E)=0.6, P(F)=0.3 and P(E∩F)= 0.2. Find P(E/F).

5 MARK QUESTIONS

1. Prove that $\frac{1}{1+\log_c ab} + \frac{1}{1+\log_a bc} + \frac{1}{1+\log_b ca} = 1$
2. If $x = \log_c ab$, $y = \log_b bc$, $z = \log_a ca$,
   Prove that $xyz = x + y + z + 2$
3. If $x = \log_{2a} a$, $y = \log_{3a} 2a$, $z = \log_{4a} 3a$, prove that $xyz + 1 = 2yz$
4. If $a^2 + b^2 = 7ab$, prove that $\log\left(\frac{a+b}{3}\right) = \frac{1}{2}(\log a + \log b)$
5. Solve for x given that $(\log_2 x)^2 + (\log_2 x) - 20 = 0$

6 MARK QUESTIONS

1. An integer is chosen at random from the numbers ranging from 1 to 50 . What is the probability that the integer chosen is a multiple of 3 or 10 ?
2. Two unbiased dice are thrown once . Find the probability of getting the sum of the numbers obtained on the two dice is neither a multiple of 2 nor a multiple of 4 .
3. One card is drawn from a well shuffled pack of 52 cards. If E is the event "the card drawn is a king or an ace" and F is the event " the card drawn is an ace or a jack " then find the conditional probability of the event E, when the event F has already occurred .
4. A pair of dice is thrown once. If the two numbers appearing on them are different, find the probability that the sum of the numbers is 6.
5. A family has two children. What is the probability that both the children are boys given that (i) the youngest is a boy. (ii) at least one is a boy ?

UNIT-4: ALLIED ANGLES AND COMPOUND ANGLES

ALLIED ANGLES

3 MARKS QUESTIONS

1. Find the value of $\cos ec\left(-1110^0\right)$
2. Find the value of $\frac{\cos ec\left(180^0 - A\right)\cos A}{\sec\left(180^0 + A\right)\cos\left(90^0 + A\right)}$
3. 3.If $\sin\theta = \frac{1}{2}$ and $\frac{\pi}{2} \subset \theta \subset \pi$, find $\cos\theta$
4. 4. If A+B+C =180^0 Prove that $\cot\left(\frac{A+B}{2}\right) = \tan c/2$
5. 5.find the value of $\tan\left(\frac{7\pi}{3}\right)$

5 MARKS QUESTIONS

1. Prove that $\frac{\sin(180^0 - A)COS(360^0 - A)\tan(180^0 + A)}{COS(270 + A)\sin(90 + A)\cot(270 - A)}$ =1
2. If secx = 13/5 and $270^0 \subset x \subset 360^0$, Find the value of $\frac{3\sin x - 2\cos x}{9\cos x + 4\sin x}$
3. Find the value of $\cos 570^0 \sin 510^0 - \sin 330^0 \cos 390^0$
4. Evaluate $\frac{\sin(-\alpha)}{\sin(90^0 + \alpha)} - \frac{\cos(-\alpha)}{\cos(90 - \alpha)} - \frac{\sec(90^0 - \alpha)}{\cos(180^0 + \alpha)}$
5. Show that $\tan 225^0 x \cot 405^0 + \tan 765^0 x \cot 675^0 + \mathrm{cosec}\, 135^0 x \sec 315^0 = 0$

6 MARK QUESTIONS

1 .Evaluate $\tan 315^0 x \cot 405^0 + \tan 765^0 x \cot 675^0 + \mathrm{cosec}\, 135^0 x \sec 315^0$

2. Find x if $\frac{x\sin^2 300^0 \sec^2 240^0}{\cos 225^0 \cos ec^2 240^0} = \cot^2 315^0 \tan^2 300^0$

3. If $\sin\theta = \frac{-1}{4} and \pi \subset \theta \subset \frac{3\pi}{2}$, find the value of $\frac{\cos\theta + \tan\theta}{\cot\theta + \sec\theta}$

4. Evaluate $\frac{\sin(2\pi - A)}{\sin(\pi - A)} - \frac{\tan\left(\frac{\pi}{2} + A\right)}{\cot(2\pi + A)} + \frac{\cos ec(-A)}{\sec\left(\frac{\pi}{2} + A\right)}$

5. Show that $\tan^2(315^0)\cot(-405^0) + \cot(495^0)\tan(-585^0) = 0$

COMPOUND ANGLES

3 MARKS QUESTIONS

1. Find the value of $\sin 15^0$
2. Show that $\tan(45^0 + \theta) = \frac{1 + \tan\theta}{1 - \tan\theta}$
3. Prove that $\frac{\sin(A - B)}{\cos A \cos B} + \frac{\sin(B - C)}{\cos B \cos C} + \frac{\sin(C - A)}{\cos C \cos A} = 0$
4. Using tan(A+B), prove that cot(A+B)=$\frac{\cot A \cot B - 1}{\cot A + \cot B}$
5. Prove that $\frac{\sin 2A}{\sin A} - \frac{\cos 2A}{\cos A} = \sin A$

5 MARKS QUESTIONS

1. Prove that cos(A-B) cos(A+B)= $\cos^2$A-$\sin^2$B
2. Show that $\sin\left(A+\frac{\pi}{4}\right)+\cos\left(A+\frac{\pi}{4}\right)=\sqrt{2}\cos A$
3. If sinA=$\frac{1}{\sqrt{10}}, \sin B=\frac{1}{\sqrt{5}}$ $provethat A+B=45^0$
4. Prove that $\tan 3\theta-\tan 2\theta-\tan\theta=\tan\theta\tan 2\theta\tan 3\theta$
5. If A+B = $\frac{\pi}{4}$, $provethat (1+\tan A)(1+\tan B))=2$

TRASFORMATION FORMULAE

3 MARKS QUESTIONS

1 P.T $\frac{\cos A+\cos B}{\sin A+\sin B}=\cot\left(\frac{A+B}{2}\right)$

2 P.T $\frac{\sin 68°+\sin 52°}{\cos 68°+\cos 52°}=\sqrt{3}$

3 Show that $\cos 40°-\cos 50°=\sqrt{2}\ \ \sin 5°$

4 Show that $\sin 47°+\cos 77°=\cos 17°$

5 Show that $\cos 80°+\cos 40°-\cos 20°=0$

MARKS QUESTIONS

1 P.T $\frac{\sin\theta+\sin 3\theta+\sin 5\theta}{\cos\theta+\cos 3\theta+\cos 5\theta}=\tan 3\theta$

2 In and triangle ABC prove that tanA + tanB +tanC = tanA tanB tanC

3 Show that $\frac{\sin 9°+\cos 9°}{\cos 9°-\sin 9°}=\tan 54°$

4 Prove that $\cos 55°+\cos 65°+\cos 175°=0$

5 Prove that $\sin 20°\times\sin 40°\times\sin 80°=\frac{\sqrt{3}}{8}$

MARKS QUESTIONS

1 Prove that $\cos 20^0 x \cos 40^0 x \cos 80^0 x \cos 60^0$= 1/16

2 In any triangle ABC prove that sinA + sinB + sinC=4Cos(A/2)cos(B/2)cos(C/2)

3 Show that $\frac{\cos x+\cos 2x-\cos 3x-\cos 4x}{\sin x+\sin 2x+\sin 3x+\sin 4x}=\tan x$

4 If A+B+C = 180^0 prove that $\cos^2 A+\cos^2 B+\cos^2 C=1-2\cos A\cos B\cos C$

5 If A+B+C = 180^0 prove that sin2A-sin2B+sin2C=4cosAcosCsinB

UNIT-5: COMPLEX NUMBERS

3 MARK QUESTIONS

1. Evaluate i^{-999}
2. Find the complex conjugate of $(1+2i)(3i-4)$
3. Express $(3+4i)^{-1}$ in the form a+ib
4. Find the real part and imaginary part of $\frac{1}{\sqrt{2}+i}$
5. $if x+iy=\cos\theta+i\sin\theta$ show that $x+\frac{1}{x}=2\cos\theta$

5 MARK QUESTIONS

1. Evaluate $\left(i^{19}+\left(\frac{1}{i}\right)^{25}\right)^2$
2. Find the modulus and amplitude of $\left(1-i\sqrt{3}\right)$
3. Express in a + ib form: $\frac{(2+3i)}{(1+3i).(2+i)}$
4. Express the complex number 1 + i in the polar form.
5. Find the amplitude of $\sqrt{3}+i$ and represent in Argand diagram.

UNIT-6: INTRODUCTION TO CALCULUS

3 MARK QUESTIONS

1. Evaluate: $\lim_{x\to-3}\frac{x^2-9}{x+3}$
2. Evaluate: $\lim_{\theta\to0}\left(\frac{\tan m\theta}{\sin n\theta}\right)$
3. Evaluate: $\lim_{n\to\infty}\left(\frac{n+1}{n}\right)^n$.
4. Evaluate: $\lim_{x\to\infty}\left(\frac{3x^2-2x+1}{2x^2+5x-1}\right)$
5. Evaluate: $\lim_{x\to0}\left(\frac{1-\cos 2x}{x^2}\right)$

5 MARK QUESTIONS

1. Evaluate: $\lim_{x\to1}\frac{x^2+x-2}{x^2-1}$.
2. Evaluate: $\lim_{x\to0}\left(\frac{\sqrt{a+x}-\sqrt{a-x}}{3x}\right)$
3. Evaluate: $\lim_{x\to1}\left(\frac{x^m-1}{x^n-1}\right)$

4. Evaluate: $\lim\limits_{\theta \to 0}\left(\frac{1-\cos x+\tan^2 x}{x\sin x}\right)$

5. Evaluate: $\lim\limits_{x \to 0}\left(\frac{e^{ax}-e^{bx}}{x}\right)$.

6 MARK QUESTIONS

1. Prove that $\boldsymbol{\lim\limits_{\theta \to 0}\frac{\sin\theta}{\theta} = 1}$, if θ is in "radian".
2. Evaluate: $\lim\limits_{x \to 0}\left(\frac{\sin \pi x}{x-1}\right)$
3. Evaluate: $\lim\limits_{n \to \infty}\left(\frac{(5-n^2)(n-2)}{(2n-3)(n+3)(5-n)}\right)$.
4. Evaluate: $\lim\limits_{x \to 1}\frac{x^2-5x+4}{x^2-12x+11}$.
5. Evaluate: $\lim\limits_{x \to 2}\left(\frac{x^2-4}{\sqrt{x+2}-\sqrt{3x-2}}\right)$

Government of Karnataka
Department of Technical Education, Bengaluru

Course: ENGINEERING MATHEMATICS - I

Course code: 15SC01M

Curriculum Drafting Committee 2015-16

	Name	Designation	Institution
1	**Dr. D.S. Prakash**	Asst. Director (LRDC)	DTE, Bengaluru
2	**Dr.MokaShekhu, ,**	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
3	**Sri.Sathyanaraya Dixit,**	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru
4	**Sri. Guruprasad V**	Lecturer (Selection Grade /Science)	APS Polytechnic, Somanahalli
5	**Dr.RajasekharHeera,**	Lecturer/Science,	Government Polytechnic, Gulbarga.

Curriculum Review committee

	Name	Designation	Institution
1	**Dr.MokaShekhu, ,**	Lecturer (Selection Grade /Science)	Government Polytechnic, Channasandra, Bengaluru
2	**Sri.Sathyanaraya Dixit,**	Lecturer (Selection Grade /Science)	PVP Polytechnic, Bengaluru