INSTITUTE OF AERONAUTICAL ENGINEERING

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

ASSIGNMENT

Course Name	**MATHEMATICS-II**
Course Code	A30006
Class	II B. Tech I Semester
Branch	Mechanical Engineering
Year	2016 – 2017
Course Faculty	Ms. P. Rajani, Associate Professor, Freshman Engineering

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

ASSIGNMENT – I & II

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-I **(SHORT ANSWER TYPE QUESTIONS)** **UNIT – I**		
1	Define divergence?	Remember	1
2	Define curl?	Remember	1
3	Evaluate the angle between the normal to the surface xy= z^2 at the points (4,1,2) and (3,3,-3)?	Understand	1
4	Find a unit normal vector to the given surface $x^2y+2xz=4$ at the point (2,-2,3)?	Apply	1
5	If $\bar{a}$ is a vector then prove that grad $(\bar{a},\bar{r}) = \bar{a}$?	Understand	1
6	Prove that F=yzi+zxj+xyk is irrotational?	Analyze	1
7	Show that (x+3y)i+(y-2z)j+(x-2z)k is solenoidal?	Understand	1
8	Define line integral?	Remember	2
9	Define volume integral?	Remember	2
10	State Gauss divergence theorem?	Understand	3
	(LONG ANSWER QUESTIONS) **UNIT-I**		
1	Prove that $\nabla f(r) = \frac{\bar{r}}{r}.f^1(r)$	Analyze	1
2	Prove that $div(r^n.\bar{r}) = (n+3)r^n$. Hence Show that $\frac{\bar{r}}{r^3}$ is solenoidal Vector	Analyze	1

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
3	If $\bar{F} = (5xy - 6x^2)\bar{i} + (2y - 4x)\bar{j}$ evaluate $\int_C \bar{F}.d\bar{r}$ along the curve C in xy plane $y=x^3$ from (1,1) to (2,8).	Understand	2
4	Evaluate $\iint_S \bar{A}.\bar{n}ds$ where $\bar{A} = Z\bar{i} + x\bar{j} - 3y^2 z\bar{k}$ and S is the surface of the cylinder $x^2+y^2=16$ included in the first octant between Z=0 and Z=5	Understand	2
5	Evaluate $\iint_s \bar{F}.d\bar{s}$ if $f = yzi + 2y^2 j + xz^2 k$ and S is the Surface of the Cylinder $x^2+y^2=9$ contained in the first Octant between the planes z=0 and z=2.	Understand	2
6	Verify gauss divergence theorem for the vector point function $F=(x^3-yz)i-2yxj+2zk$ over the cube bounded by x=y=z=0and x=y=z=a	Apply	3
7	Verify divergence theorem for $2x^2yi - y^2 j + 4xz^2 k$ taken over the region of first octant of the cylinder $y^2 + z^2 = 9$ and $x = 2$	Apply	3
8	Applying Green's theorem evaluate $\int (y - \sin x)dx + \cos x\, dy$ where C is the plane Δ^{le} enclosed by $y = 0,\ y = \frac{2x}{\pi},\ and\ x = \frac{\pi}{2}$	Apply	3
9	Verify Green's Theorem in the plane for $\int_c (x^2 - xy^3)dx + (y^2 - 2xy)dy$ where C is a square with vertices (0,0),(2,0),)(2,2),(0,2)	Apply	3
10	Verify Stokes theorem for $f = (x^2 - y^2)i + 2xyj$ over the box bounded by the planes x=0,x=a,y=0,y=b,z=c	Apply	3
	(SHORT ANSWER TYPE QUESTIONS) **UNIT-II**		
1	Define Euler's formulae	Remember	5
2	Write Dirichlet's conditions	Understand	4
3	If f(x)= $x^2 - 2$ in (-2,2) then find b_2	Apply	5
4	If f(x)= x^2 in (-2,2) then a_0	Apply	5
5	If f(x)= $\sin^3 x$ in ($-\pi$, π) then find a_n	Apply	5
6	If f(x)= x^4 in (-1,1) then find b_n	Apply	5
7	Write about Fourier sine and cosine integral	Understand	6
8	Find the finite Fourier cosine transform of f(x)=1in 0<x<π	Apply	6
9	Find the inverse finite sine transform f(x) if $F_s(n) = \frac{1-cosn\pi}{n^2\pi^2}$	Apply	6
10	Write the properties of Fourier transform	Understand	6
	(LONG ANSWER QUESTIONS) **UNIT-II**		
1	Obtain the Fourier series expansion of f(x) given that $f(x) = (\pi - x)^2$ in $0 < x < 2\pi$ and deduce the value of $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + ... = \frac{\pi^2}{6}$.	Understand	5
2	Find the Fourier Series to represent the function $f(x) = \lvert \sin x \rvert$ in $-\pi$ <x< π .	Apply	5
3	Find the Fourier series to represent $f(x) = x^2\ in\ (0,2\pi)$.	Apply	5
4	Expand the function $f(x) = x^2$ as a Fourier series in $(-\pi, \pi)$.	Understand	5

<table>
<tr><th>S.No</th><th>QUESTION</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td>5</td><td>Find the Fourier series to represent the function f(x) given by:
$$f(x)=\begin{cases}0\ for -\pi\le x\le 0\\ x^2\ for\, 0\le x<\pi\end{cases}$$</td><td>Apply</td><td>5</td></tr>
<tr><td>6</td><td>Expand f(x)=cosx for $0<x<\pi$ in half range sine series</td><td>Understand</td><td>5</td></tr>
<tr><td>7</td><td>Using Fourier integral show that $e^{-x}cosx = \frac{2}{\pi}\int_0^{\infty}\frac{\lambda^2+2}{\lambda^4+4}cos\lambda x dx$</td><td>Understand</td><td>6</td></tr>
<tr><td>8</td><td>Find the Fourier transform of $f(x)=\begin{cases}a^2-x^2\ if\ |x|<a\\ 0\quad if\ |x|>a\end{cases}$ Hence show that
$$\int_0^{\infty}\frac{\sin x-\cos x}{x^3}dx=\frac{\pi}{4}$$</td><td>Apply</td><td>6</td></tr>
<tr><td>9</td><td>Find the Fourier sine transform for the function f(x) given by
$$f(x)=\begin{cases}\sin x,\ \ 0<x<a\\ 0\qquad x\ge a\end{cases}$$</td><td>Apply</td><td>6</td></tr>
<tr><td>10</td><td>Find the inverse Fourier transform f(x) of $F(p) = e^{-|p|y}$</td><td>Apply</td><td>6</td></tr>
<tr><td colspan="4">(SHORT ANSWER TYPE QUESTIONS)
UNIT-III</td></tr>
<tr><td>1</td><td>Define Interpolation and extrapolation</td><td>Remember</td><td>7</td></tr>
<tr><td>2</td><td>Explain forward difference interpolation</td><td>Understand</td><td>7</td></tr>
<tr><td>3</td><td>Construct a forward difference table for f(x)=x^3+5x-7 if
x=-1,0,1,2,3,4,5</td><td>Analyze</td><td>9</td></tr>
<tr><td>4</td><td>Evaluate Δ log f(x)</td><td>Understand</td><td>9</td></tr>
<tr><td>5</td><td>Find the missing term in the following table
<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Y</td><td>1</td><td>3</td><td>9</td><td>------</td><td>81</td></tr></table></td><td>Apply</td><td>8</td></tr>
<tr><td colspan="4">(LONG ANSWER QUESTIONS)
UNIT-III</td></tr>
<tr><td>1</td><td><table><tr><td>x</td><td>20</td><td>25</td><td>30</td><td>35</td><td>40</td><td>45</td></tr><tr><td>y</td><td>354</td><td>332</td><td>291</td><td>260</td><td>231</td><td>204</td></tr></table>Find f(22), from the following data using Newton's Backward formula.</td><td>Apply</td><td>8</td></tr>
<tr><td>2</td><td>Given sin 45=0.7071,sin 50=0.7660,sin 55=0.8192 and sin 60=0.8660 find sin 52 using newton's formula</td><td>Apply</td><td>8</td></tr>
<tr><td>3</td><td>The population of a town in the decimal census was given below. Estimate the population for the year 1895
<table><tr><td>Year (x)</td><td>1891</td><td>1901</td><td>1911</td><td>1921</td><td>1931</td></tr><tr><td>Population (y)</td><td>46</td><td>66</td><td>81</td><td>93</td><td>101</td></tr></table></td><td>Understand</td><td>8</td></tr>
<tr><td>4</td><td>Find by Gauss's backward interpolating formula the value of y at x = 1936 using the following table
<table><tr><td>X</td><td>1901</td><td>1911</td><td>1921</td><td>1931</td><td>1941</td><td>1951</td></tr><tr><td>Y</td><td>12</td><td>15</td><td>20</td><td>27</td><td>39</td><td>52</td></tr></table></td><td>Apply</td><td>8</td></tr>
<tr><td>5</td><td>Find f (1.6) using Lagrange's formula from the following table.
<table><tr><td>x</td><td>1.2</td><td>2.0</td><td>2.5</td><td>3.0</td></tr><tr><td>f(x)</td><td>1.36</td><td>0.58</td><td>0.34</td><td>0.20</td></tr></table></td><td>Apply</td><td>8</td></tr>
<tr><td colspan="4">ASSIGNMENT – II</td></tr>
</table>

<table>
<tr><th>S.No</th><th>QUESTION</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td colspan="4">(SHORT ANSWER TYPE QUESTIONS)
UNIT-III</td></tr>
<tr><td>1</td><td>What is the principle of method of least square</td><td>Understand</td><td>9</td></tr>
<tr><td>2</td><td>Define curve fitting</td><td>Remember</td><td>8</td></tr>
<tr><td>3</td><td>Derive the normal equations for straight line</td><td>Understand</td><td>8</td></tr>
<tr><td>4</td><td>Derive the normal equations for second degree parabola</td><td>Understand</td><td>8</td></tr>
<tr><td>5</td><td>Write the normal equations to fit the curve $y = ae^{bx}$</td><td>Understand</td><td>8</td></tr>
<tr><td colspan="4">(LONG ANSWER QUESTIONS)
UNIT-III</td></tr>
<tr><td>1</td><td>A curve passes through the points (0, 18),(1,10), (3,-18) and (6,90). Find the slope of the curve at x = 2.</td><td>Apply</td><td>7</td></tr>
<tr><td>2</td><td>By the method of least square, find the straight line that best fits the following data:
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>14</td><td>27</td><td>40</td><td>55</td><td>68</td></tr>
</table></td><td>Apply</td><td>7</td></tr>
<tr><td>3</td><td>Fit a curve $y=a+bx+cx^2$ from the following data
<table>
<tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Y</td><td>6</td><td>11</td><td>18</td><td>27</td></tr>
</table></td><td>Understand</td><td>7</td></tr>
<tr><td>4</td><td>Using the method of least squares find the constants a and b such that $y=ae^{bx}$ fits the following data:
<table>
<tr><td>x</td><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td></tr>
<tr><td>y</td><td>0.10</td><td>0.45</td><td>2.15</td><td>9.15</td><td>40.35</td><td>180.75</td></tr>
</table></td><td>Apply</td><td>7</td></tr>
<tr><td>5</td><td>Obtain a relation of the form $y=ab^x$ for the following data by the method of least squares.
<table>
<tr><td>x</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>y</td><td>8.3</td><td>15.4</td><td>33.1</td><td>65.2</td><td>127.4</td></tr>
</table></td><td>Understand</td><td>7</td></tr>
<tr><td colspan="4">(SHORT ANSWER TYPE QUESTIONS)
UNIT-IV</td></tr>
<tr><td>1</td><td>Define algebraic and transcendental equation and give example</td><td>Remember</td><td>10</td></tr>
<tr><td>2</td><td>Write about bisection method</td><td>Understand</td><td>10</td></tr>
<tr><td>3</td><td>Write about false position method</td><td>Understand</td><td>10</td></tr>
<tr><td>4</td><td>State the condition for convergence of the root by iterative method</td><td>Understand</td><td>10</td></tr>
<tr><td>5</td><td>Find the square root of a number 16 by using Newton’s Raphson</td><td>Apply</td><td>10</td></tr>
<tr><td>6</td><td>Explain LU decomposition method</td><td>Apply</td><td>11</td></tr>
<tr><td>7</td><td>Define Crout’s and Doolittle’s method</td><td>Remember</td><td>11</td></tr>
<tr><td>8</td><td>If A=LU and $A = \begin{bmatrix} 1 & 5 \\ 2 & 3 \end{bmatrix}$ then find L</td><td>Apply</td><td>11</td></tr>
<tr><td>9</td><td>Explain the procedure to find the inverse of the matrix by using LU decomposition method</td><td>Understand</td><td>11</td></tr>
<tr><td>10</td><td>Write the difference between Jacobi’s and Gauss Seidel iterative method</td><td>Understand</td><td>11</td></tr>
<tr><td colspan="4">(LONG ANSWER QUESTIONS)
UNIT-IV</td></tr>
<tr><td>1</td><td>Find the square root of 25 up to 2 decimal place s by using bisection method</td><td>Apply</td><td>10</td></tr>
</table>

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
2	Find a real root of the equation $e^x \sin x = 1$, using Regulafalsi method	Apply	10
3	Solve 2x=cosx+3 by iterative method	Understand	10
4	Find a real root of the equation, $\log x = \cos x$ using Regulafalsi method	Apply	10
5	Find a real root of 3x-cosx-1=0 using Newton Raphson method	Apply	10
6	Evaluate x tanx+1=0 by Newton Raphson method.	Understand	10
7	Solve x+3y+8z=4, x+4y+3z=-2, x+3y+4z=1 using LU decomposition	Understand	11
8	Solve 5x-y+3z=10,3x+6y=18,x+y+5z=-10 with initial approximations (3,0,-2) by Jacobi's iteration method	Understand	11
9	Using Jacobi's iteration method solve the system of equation 10x+4y-2z=12, x-10y-z=-10,5x+2y-10z=-3	Understand	11
10	Using Gauss-seidel iterative method solve the system of equations 5x+2y+z=12, x+4y+2z=15, x+2y+5z=20	Understand	11
	(SHORT ANSWER TYPE QUESTIONS) **UNIT-V**		
1	Explain Trapezoidal rule	Understand	12
2	Explain Simpson's 1/3 and 3/8 rule	Understand	12
3	Estimate $\int_0^{\Pi/2} e^{\sin x} dx$ taking h=∏/6correct o four decimal places	Understand	12
4	Explain two point and three point Gaussian quadrature	Understand	12
5	Compute using Gauss integral $\int_{-1}^{1} \sqrt{1-x^2}\, dx, n=3$	Apply	12
6	Explain Taylor's series method and limitations	Understand	13
7	Explain Picard's method of successive approximation Write the second approximation for $y^1=x^2+y^2, y(0)=1$	Understand	13
8	Give the difference between Euler's method and Euler's modified method	Analyze	13
9	Find y(0.1) given $y^1=x^2-y, y(0)=1$ by Euler's method	Apply	13
10	Explain Runge-Kutta second and classical fourth order	Understand	13
	(LONG ANSWER QUESTIONS) **UNIT-V**		
1	Evaluate $\int_0^{\pi} \left(\frac{\sin x}{x}\right) dx$ by using i) Trapezoidal rule ii) Simpson's $\frac{1}{3}$ rule taking n=6	Understand	12
2	Using Taylor's series method, find an approximate value of y at x=0.2 for the differential equation $y' - 2y = 3e^x$ for y(0)=0.	Apply	13
3	Given $y^1 = 1 + xy, y(0) = 1$ compute y (0.1), y (0.2) using Picard's method	Understand	13

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
4	Solve by Euler's method $\frac{dy}{dx} = \frac{2y}{x}$ given y(1)=2 and find y(2).	Understand	13
5	Find y(0.1) and y(0.2) using Euler's modified formula given that $\frac{dy}{dx} = x^2 - y$ and y(0)=1	Apply	13
6	Find y(0.1) and y(0.2) using Runge Kutta fourth order formula given that $\frac{dy}{dx} = x + x^2 y$ and y(0)=1.	Apply	13
7	using Runge Kutta method of order 4 find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}, y(0) = 1, h = 0.2$	Apply	13
8	Use power method find numerically largest Eigen value $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and corresponding Eigen vector and other Eigen value	Apply	14
9	Use power method find numerically largest Eigen value $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$	Apply	14
10	Write the largest Eigen value of the matrix $\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$	Understand	14

Prepared By : Ms. P. Rajani, Associate Professor, Freshman Engineering

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