## SCHEME OF VALUATION
### (Scoring Indicators)

Revision : 2015 Course Code: 2002

Course Title: ENGINEERING MATHEMATICS – II

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| I | PART – A | | | |
| 1. | $\vec{a}\cdot\vec{b} = (1\cdot 2)+(1\cdot -1)+(1\cdot 3)$ | 1 | 2 | |
| | $= 2-1+3 = 4$ | 1 | | |
| 2. | $9x-14=0$ | 1 | 2 | |
| | $x = \frac{14}{9}$ | 1 | | |
| 3. | $A = \begin{bmatrix}1 & 2\\0 & 3\end{bmatrix} - \begin{bmatrix}3 & 5\\2 & 7\end{bmatrix}$ | 1 | 2 | 10 |
| | $= \begin{bmatrix}-2 & -3\\-2 & -4\end{bmatrix}$ | 1 | | |
| 4. | $\left[xe^{x} - e^{x}\right]_0^1$ | 1 | 2 | |
| | $= e-e+1 = 1$ | 1 | | |
| 5. | $y = 5x + C$ | 2 | 2 | |
| II | PART – B | | | |
| 1 | $\vec{AB} = \hat{i}+\hat{j}+6\hat{k}$ | 1 | | |
| | $\vec{AC} = -\hat{i}+\hat{j}+3k$ | 1 | | |

**SCHEME OF VALUATION**
**(Scoring Indicators)**

| Revision : | | Course Code: | | |
|---|---|---|---|---|
| **Course Title:** | | | | |
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | $\vec{AB} \times \vec{AC} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 6 \\ -1 & 1 & 3 \end{vmatrix}$ | 1 | | |
| | $= -3\hat{i} - 9\hat{j} + 2\hat{k}$ | 1 | | |
| | Area of triangle $= \frac{1}{2}\lvert\vec{AB} \times \vec{AC}\rvert$ | 1 | 6 | |
| | $= \frac{1}{2}\sqrt{(-3)^2 + (-9)^2 + 2^2}$ | | | |
| | $= \frac{\sqrt{94}}{2}$ sq. units. | 1 | | |
| 2. | Let $(r+1)^{th}$ term be the constant term | 1 | | |
| | $(r+1)^{th}$ term $= nC_r x^{n-r} a^r$ | | | |
| | $= 9C_r (x^2)^{9-r} \left(\frac{-1}{x}\right)^r$ | 1 | | |
| | $= 9C_r (-1)^r x^{18-3r}$ | 1 | 6 | |
| | $\Rightarrow x^{18-3r} = x^0$ | | | |
| | $\Rightarrow 18 - 3r = 0$ | 1 | | |
| | $\Rightarrow r = 6$ | 1 | | |

## SCHEME OF VALUATION
### (Scoring Indicators)

| Revision : <br> Course Title: | Course Code: | | | |
|---|---|---|---|---|
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | constant term = $^9C_6$ | 1 | | |
| 3. | $\Delta = \begin{vmatrix} 1 & 1 & -4 \\ -4 & 1 & 1 \\ 1 & -4 & 1 \end{vmatrix} = -50$ | $\frac{1}{2}+\frac{1}{2}$ | | |
| | $\Delta_1 = \begin{vmatrix} -8 & 1 & -4 \\ 2 & 1 & 1 \\ -3 & -4 & 1 \end{vmatrix} = -25$ | $\frac{1}{2}+\frac{1}{2}$ | | |
| | $\Delta_2 = \begin{vmatrix} 1 & -8 & -4 \\ -4 & 2 & 1 \\ 1 & -3 & 1 \end{vmatrix} = -75$ | $\frac{1}{2}+\frac{1}{2}$ | 6 | |
| | $\Delta_3 = \begin{vmatrix} 1 & 1 & -8 \\ -4 & 1 & 2 \\ 1 & -4 & -3 \end{vmatrix} = -125$ | $\frac{1}{2}+\frac{1}{2}$ | | |
| | $x = \frac{\Delta_1}{\Delta} = \frac{1}{2}$ <br> $y = \frac{\Delta_2}{\Delta} = \frac{3}{2}$ <br> $z = \frac{\Delta_3}{\Delta} = \frac{5}{2}$ | 2 | | |

## SCHEME OF VALUATION
### (Scoring Indicators)

Revision :
**Course Code:**
**Course Title:**

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| 4 | $AB = \begin{bmatrix} (-6+3+8) & (12-1+2) & (3+2+6) \\ (2+6+12) & (-4-2+3) & (-1+4+9) \\ (-4-15+28) & (8+5+7) & (2-10+21) \end{bmatrix}$ | 1 | | |
| | $= \begin{bmatrix} 5 & 13 & 11 \\ 20 & -3 & 12 \\ 9 & 20 & 13 \end{bmatrix}$ | 1 | | |
| | $BA = \begin{bmatrix} (-6-4+2) & (-2+8-5) & (-4+12+7) \\ (9+1+4) & (3-2-10) & (6-3+14) \\ (12-1+6) & (4+2-15) & (8+3+21) \end{bmatrix}$ | 1 | 6 | |
| | $= \begin{bmatrix} -8 & 1 & 15 \\ 14 & -9 & 17 \\ 17 & -9 & 32 \end{bmatrix}$ | 1 | | |
| | $AB \neq BA$ | 1 | | |
| | AB & BA do not commute. | 1 | | |
| 5 | $\sin 3x \cos x = \frac{1}{2}(\sin 4x + \sin 2x)$ | 1 | | |
| | $\int \sin 3x \cos x \, dx = \frac{1}{2}\left[\frac{-\cos 4x}{4} - \frac{\cos 2x}{2}\right]$ | 2 | | |

**SCHEME OF VALUATION**
**(Scoring Indicators)**

| Revision : **Course Title:** | | **Course Code:** | | |
|---|---|---|---|---|
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | $\int_0^{\pi/2} \sin 3x \cos x\, dx$ | | | |
| | $= \frac{1}{2}\left[\left[\frac{-\cos 4\frac{\pi}{2}}{4} + \frac{-\cos 2\frac{\pi}{2}}{2}\right] - \left(\frac{-\cos 0}{4} + \frac{-\cos 0}{2}\right)\right]$ | 2 | 6 | |
| | $= \frac{1}{2}$ | 1 | | |
| 6 | $x^2 - 3x - 4 = 0$ <br> $x = -1,\ x = 4$ | 2 | | |
| | $\text{Area} = \int_{-1}^{4} (x^2 - 3x - 4)\, dx$ | 1 | 6. | |
| | $= \left[\frac{x^3}{3} - \frac{3x^2}{2} - 4x\right]_{-1}^{4}$ | 2 | | |
| | $= \frac{125}{6}$ sq. units | 1 | | |
| 7. | $\frac{dy}{dx} + \frac{1}{(1+x^2)} y = \frac{e^{\tan^{-1}x}}{1+x^2}$ | 1 | | |
| | Let $P(x) = \frac{1}{1+x^2},\ Q(x) = \frac{e^{\tan^{-1}x}}{1+x^2}$ | 1 | | |

**SCHEME OF VALUATION**
**(Scoring Indicators)**

| Revision : Course Title: | | Course Code: | | |
|---|---|---|---|---|
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | $I.F = e^{\int \frac{1}{1+x^2}dx} = e^{\tan^{-1}x}$. | 1 | | |
| | solution is | | 6 | |
| | $y.e^{\tan^{-1}x} = \int e^{\tan^{-1}x} \cdot \frac{e^{\tan^{-1}x}}{1+x^2} dx$ | 2 | | |
| | $= \frac{(e^{\tan^{-1}x})^2}{2} + C$ | 1 | | |
| III (a) | **PART C** <br> UNIT - I <br> $\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -1 \\ 4 & 6 & -\lambda \end{vmatrix} = 0$ | 1 | | |
| | $\hat{i}(-3\lambda+6) - \hat{j}(-2\lambda+4) + \hat{k}(12-12) = 0$ | 2 | 5 | |
| | $\Rightarrow 3\lambda = 6 \ \& \ 2\lambda = 4$ | 1 | | 15 |
| | $\Rightarrow \lambda = 2$ | 1 | | |
| (b) | Resultant force $\vec{F} = 7\hat{i} + 2\hat{j} - 4\hat{k}$ | 1 | | |
| | Displacement $\vec{AB} = 4\hat{i} + 2\hat{j}$ | 1 | 5 | |
| | Workdone $= \vec{F} \cdot \vec{AB}$ | 1 | | |

**SCHEME OF VALUATION**
**(Scoring Indicators)**

| Revision : Course Title: | | Course Code: | | |
|---|---|---|---|---|
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | $= 28+4 \quad = 32$ units | 2 | | |
| III (c) | 2 middle terms, $4^{th}$ and $5^{th}$ | 1 | 5 | |
| | $4^{th}$ term $= 7C_3 (3x)^4 \left(\frac{-x^3}{6}\right)^3$ | 1 | | |
| | $= -7C_3 \frac{3}{2^3} x^{13}$ | 1 | | |
| | $5^{th}$ term $= 7C_4 (3x)^3 \left(\frac{-x^3}{6}\right)^4$ | 1 | | |
| | $= 7C_4 \frac{1}{3\times 2^4} x^{15}$ | 1 | | |
| | **OR** | | | |
| IV (a) | $\vec{a}+\vec{b} = 6\hat{i}+2\hat{j}-8\hat{k}$ | 1 | 5 | |
| | $\vec{a}-\vec{b} = 4\hat{i}-4\hat{j}+2\hat{k}$ | 1 | | |
| | $(\vec{a}+\vec{b}).(\vec{a}-\vec{b}) = 0$ | 1 | | |
| | $(\vec{a}+\vec{b}).(\vec{a}-\vec{b}) =$ $24-8-16 = 0$ | 2 | | |

## SCHEME OF VALUATION
### (Scoring Indicators)

Revision :

**Course Title:** **Course Code:**

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| IV (b) | $\vec{BA} = \hat{i} + \hat{j} + 4\hat{k}$ | 1 | | |
| | $\vec{BA} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 4 \\ 4 & 0 & -3 \end{vmatrix}$ | 1 | 5 | |
| | $= -3\hat{i} + 19\hat{j} - 4\hat{k}$ | 1 | | |
| | Moment $= \lvert \vec{BA} \times \vec{F} \rvert$ | 1 | | |
| | $= \sqrt{386}$ units. | 1 | | 15 |
| (c) | $(3a+2b)^4$ $= (3a)^4 + 4C_1(3a)^3(2b) + 4C_2(3a)^2(2b)^2 + 4C_3(3a)(2b)^3 + (2b)^4$ | 2 | | |
| | $= (3a)^4 + 4(3a)^3(2b) + 6(3a)^2(2b^2)^2 + 4(3a)(2b)^3 + (2b)^4$ | 1 | 5 | |
| | $= 3^4a^4 + 8 \cdot 3^3a^3b + 2^2 3^2 6a^2b^2 + 12 \cdot 2^3ab^3 + 2^4b^4$ | | | |
| | $= 81a^4 + 216a^3b + 216a^2b^2 + 96ab^3 + 16b^4$ | 2 | | |

# SCHEME OF VALUATION
## (Scoring Indicators)

Revision :
**Course Title:** **Course Code:**

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| | UNIT - II | | | |
| V(a) | Put $1/x = X$, $1/y = Y$ | $\frac{1}{2}+\frac{1}{2}$ | | |
| | $2X + 3Y = 5$ <br> $2X + 5Y = 3$ | $1/2$ | | |
| | $\Delta = \begin{vmatrix} 2 & 3 \\ 2 & 5 \end{vmatrix} = 4$ | $\frac{1}{2}$ | 5 | |
| | $\Delta_1 = \begin{vmatrix} 5 & 3 \\ 3 & 5 \end{vmatrix} = 16$ | $\frac{1}{2}$ | | |
| | $\Delta_2 = \begin{vmatrix} 2 & 5 \\ 2 & 3 \end{vmatrix} = -4$ | $\frac{1}{2}$ | | |
| | $X = \frac{\Delta_1}{\Delta} = 4$ <br> $Y = \frac{\Delta_2}{\Delta} = -1$ | $\frac{1}{2}+\frac{1}{2}$ | | 15 |
| | $\Rightarrow x = 1/4$, $y = -1$ | $\frac{1}{2}+\frac{1}{2}$ | | |
| V(b) | $A(\theta') = \begin{bmatrix} \cos\theta' & -\sin\theta' \\ \sin\theta' & \cos\theta' \end{bmatrix}$ | 1 | | |
| | $A(\theta)\,A(\theta') = \begin{bmatrix} \cos\theta\cos\theta' - \sin\theta\sin\theta' & -\sin\theta\cos\theta' - \sin\theta'\cos\theta \\ \sin\theta\cos\theta' + \cos\theta\sin\theta' & -\sin\theta\sin\theta' + \cos\theta\cos\theta' \end{bmatrix}$ | 2 | 5 | |

## SCHEME OF VALUATION
### (Scoring Indicators)

| Revision : | | Course Code: | | |
|---|---|---|---|---|
| **Course Title:** | | | | |
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | $= \begin{bmatrix} \cos(\theta+\theta') & -\sin(\theta+\theta') \\ \sin(\theta+\theta') & \cos(\theta+\theta') \end{bmatrix}$ <br> $= A(\theta+\theta')$ | 2 | | |
| $\underline{\bar{V}}$ (c) | cofactors & | 3 | | |
| | cofactor matrix $= \begin{bmatrix} 6 & -6 & 2 \\ -5 & 8 & -3 \\ 1 & -2 & 1 \end{bmatrix}$ | 1 | 5 | |
| | Adjoint Matrix $= \begin{bmatrix} 6 & -5 & 1 \\ -6 & 8 & -2 \\ 2 & -3 & 1 \end{bmatrix}$ | 1 | | |
| | **OR** | | | |
| $\underline{\bar{VI}}$ (a) | $\begin{vmatrix} 2 & 1 & x \\ 3 & -1 & 2 \\ 1 & 1 & 6 \end{vmatrix} = 4x-32$ | 2 | | |
| | $\begin{vmatrix} 4 & x \\ 3 & 2 \end{vmatrix} = 8-3x$ | 2 | 5 | |
| | $x = \frac{40}{7}$. | 1 | | |

**SCHEME OF VALUATION**
**(Scoring Indicators)**

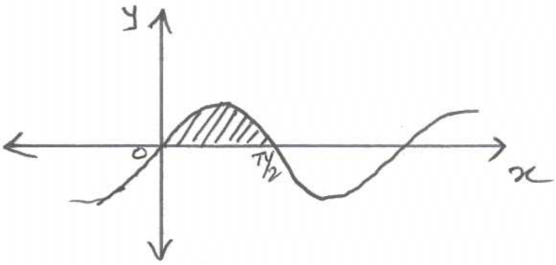
| Revision : | | Course Code: | | |
|---|---|---|---|---|
| **Course Title:** | | | | |
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| VI (b) | $A^T = \begin{bmatrix} 1 & -2 & 3 \\ 0 & 1 & 2 \\ 5 & 6 & 7 \end{bmatrix}$ | 1 | | |
| | $A + A^T = \begin{bmatrix} 2 & -2 & 8 \\ -2 & 2 & 8 \\ 8 & 8 & 14 \end{bmatrix}$ | 2 | 5 | |
| | $(A+A^T)^T = A + A^T$ | 2 | | 15 |
| VI (c) | $A^3 = \begin{bmatrix} 8 & 21 \\ 0 & 1 \end{bmatrix}$ | 1 | | |
| | $A^2 = \begin{bmatrix} 4 & 9 \\ 0 & 1 \end{bmatrix}$, $3A^2 = \begin{bmatrix} 12 & 27 \\ 0 & 3 \end{bmatrix}$ | 1+1 | | |
| | $2A = \begin{bmatrix} 4 & 6 \\ 0 & 2 \end{bmatrix}$ | 1 | 5 | |
| | $A^3 - 3A^2 + 2A + I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ | 1 | | |
| | **UNIT - III** | | | |
| VII (a) | $\int \operatorname{cosec} x \, dx = \int \frac{\operatorname{cosec} x(\operatorname{cosec} x - \cot x)}{(\operatorname{cosec} x - \cot x)} dx$ | 2 | | |
| | Let $u = \operatorname{cosec} x - \cot x$ | 1 | 5 | |
| | $\Rightarrow \int \operatorname{cosec} x \, dx = \log(\operatorname{cosec} x - \cot x) + C$ | 2 | | |

## SCHEME OF VALUATION
**(Scoring Indicators)**

| Revision : **Course Title:** | | **Course Code:** | | |
|---|---|---|---|---|
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| VII (b) | $\int \frac{x^7}{(1+x^8)^3} dx$ <br> Put $(1+x^8) = u$ <br> $x^7 dx = \frac{du}{8}$ <br> $\int \frac{du}{8u^3} = \frac{1}{8}\int u^{-3} du = \frac{1}{8} \frac{u^{-2}}{-2} + C$ <br> $\int \frac{x^7}{(1+x^8)^3} dx = \frac{-1}{16}(1+x^8)^{-2} + C$ | 1+1 <br> 1+1 <br> 1 | 5 | 15 |
| (c) | $\int \frac{1-\sin x}{(1+\sin x)(1-\sin x)} dx$ <br> $= \int (\sec^2 x - \sec x \tan x) dx$ <br> $= \tan x - \sec x + C$ | 1 <br> 2 <br> 1 | 5 | |
| | $\int_0^{\pi} \frac{1}{1+\sin x} dx = 2$ | 1 | | |
| VIII (a) | **OR** <br> Put $u = \sin x$ <br> $\Rightarrow \int \frac{du}{\sqrt{u}} = \frac{u^{1/2}}{1/2} + C$ <br> $= 2\sqrt{\sin x} + C$ | 1 <br> 1+2 <br> 1 | 5 | |

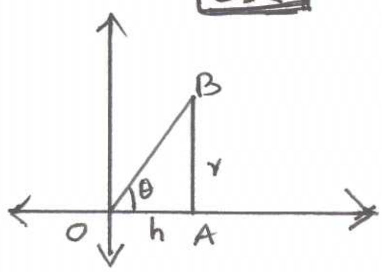
**SCHEME OF VALUATION**
**(Scoring Indicators)**

Revision : **Course Code:**
**Course Title:**

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| VIII (b) | $\int \log x \cdot x^3\,dx = \log x \cdot \frac{x^4}{4} - \int \frac{1}{x}\frac{x^4}{4}dx$ | 2 | 5 | |
| | $= \log x \cdot \frac{x^4}{4} - \frac{1}{4}\frac{x^4}{4} + C$ | 1+2 | | |
| (c) | Put $x^3+1 = u$ | 1 | | 15 |
| | $x^2 dx = \frac{du}{3}$ | | | |
| | $\int u \frac{du}{3} = \frac{1}{3}\frac{u^2}{2} + C$ | 1 | | |
| | $= \frac{1}{6}(x^3+1)^2 + C$ | 1 | 5 | |
| | $\int_0^2 x^2(x^3+1)\,dx = \left[\frac{1}{6}(x^3+1)^2\right]_0^2$ | 1 | | |
| | $= \frac{80}{6} = \frac{40}{3}$ | 1 | | |
| | **UNIT IV** | | | |
| IX(a) |   | | | |
| | $\sin 2x = 0 \Rightarrow x = 0,\ x = \pi/2$ | 1 | 5 | |
| | Area $= \int_0^{\pi/2} 3\sin 2x\,dx = 3\left[\frac{-\cos 2x}{2}\right]_0^{\pi/2}$ | 1+1 | | |
| | $= -3/2\left[\cos\pi - \cos 0\right] = 3$ sq. units | 1+1 | | |

# SCHEME OF VALUATION
## (Scoring Indicators)

Revision :
**Course Code:**
**Course Title:**

| Qst. No | Scoring Indicator | Split up score | Sub Total | Total |
|---|---|---|---|---|
| IX (b) | $\text{Volume} = \pi \int_0^{\pi/4} (2\cos x)^2 \, dx$ | 1 | | |
| | $= 4\pi \int_0^{\pi/4} \left(\frac{1+\cos 2x}{2}\right) dx$ | 1 | 5 | |
| | $= 2\pi \left[ x + \frac{\sin 2x}{2} \right]_0^{\pi/4}$ | 1 | | 15 |
| | $= 2\pi \left[ \pi/4 + \frac{1}{2} \right]$ cubic units | 2 | | |
| IX (c) | $dy = (4x-7)dx$ | 1 | | |
| | $y = 2x^2 - 7x + C$ | 1 | | |
| | $x=1, y=3 \Rightarrow$ <br> $3 = -5 + C$ | 1 | 5 | |
| | $C = 8$ | 1 | | |
| | $y = 2x^2 - 7x + 8$ | 1 | | |
| | **OR** | | | |
| X(a) |  | 1 | | |
| | slope of $OB = \tan\theta = \frac{r}{h}$ | 1 | | |

## SCHEME OF VALUATION
### (Scoring Indicators)

| Revision : | | Course Code: | | |
|---|---|---|---|---|
| **Course Title:** | | | | |
| **Qst. No** | **Scoring Indicator** | **Split up score** | **Sub Total** | **Total** |
| | Equation of OB , $y = \frac{r}{h}x$ | 1 | 5 | |
| | Volume $= \int_0^h \pi \left(\frac{r}{h}x\right)^2 dx$ | 1 | | |
| | $= \frac{\pi r^2}{h^2}\left(\frac{x^3}{3}\right)_0^h$ | ½ | | |
| | $= \frac{1}{3}\pi r^2 h$ cubic units | ½ | | |
| X (b) | $\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$ | 1 | 5 | 15 |
| | $\int \frac{dy}{1+y^2} = \int \frac{dx}{1+x^2}$ | 2 | | |
| | $\tan^{-1}y = \tan^{-1}x + C$ | 2 | | |
| X (c) | Integrating, $\frac{dy}{dx} = -\cot x + C_1$ | 2 | 5 | |
| | Again integrating $y = -\log \sin x + C_1 x + C_2$ | 2 | | |
| | $= \log(\operatorname{cosec} x) + C_1 x + C_2$ | 1 | | |