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FACULTY OF ENGINEERING & TECHNOLOGY

FE (Engg) Year Examination –June – 2015

Engineering Mathematics -II

(Revised)

[Time: Three *Hours*] **[Max. Marks:80]**

"Please check whether you have got the right question paper."

i) Question number one & six are compulsory.
ii) Attempt any two questions from the remaining 4 questions from each section.
iii) Figures to the right indicate full marks.
iv) Assume suitable data if necessary.

SECTION-A

Q.1 Attempt any five of the following 10

a) Define Gamma function & Evaluate $\int_0^\infty e^{-x} x^2 \, dx$.

b) Find the value of $\int_0^\infty \frac{x^3}{(1+x)^4} \, dx$.

c) Evaluate $\int_0^{\frac{\pi}{2}} sin^2 \, x \, dx$.

d) Find the mean value of $y = 3x^2 \;\; from \;\; x = 0 \; to \; 2$

e) The surface area of solid formed the revolution of the curve $y = f(x)$ about x-axis from $x = a \; to \; x = b$.

f) Change the order of integration $\int_0^1 \int_0^{2\sqrt{x}} f(x, y) \, dx \, dy$.

g) Evaluate $\int_{x=0}^{x=a} \int_{y=0}^{y=x^2} dx \;\; dy$

h) Evaluate $\int_0^a \int_0^b \int_0^c dx \, dy \, dz$.

Q.2 a) Evaluate $\int_0^{2a} x\sqrt{2ax - x^2 \, dx.}$ 05

b) Evalute $\int_0^4 \int_0^{x^2} e^{\frac{y}{x}} \; dx \, dy$. 05

c) Find the volume bounded by the cylinder $y^2 = x, x^2 = y$& the plane $x + y + z = 2$ & $z = 0$. 05

Q.3 a) Evaluate $\int_0^\infty \sqrt[3]{x^2 e^{-\sqrt[3]{x}} dx.}$ 05

b) Change the order of integration $\int_{-a}^{a} \int_0^{\sqrt{a^2-x^2}} f(x, y) dx \, dy$. 05

c) Find by the double integration the area included between the cures $xy = 1$ & $2x + 2y \; = 5$. 05

Q.4 a) Evaluate $\int_0^\infty \frac{x^8(1-x^6)}{(1+x)^{24}} \, dx$. 05

b) Changing into polar coordinate Evaluate $\int_0^{2a} \int_0^{\sqrt{2ax-x^2}} (x^2 + y^2) dx \;\; dy$. 05

c) Find the surface of the solid generated by the revolution of the loop of the curve $x = t^2$, y =t$-\frac{t^3}{3}$ About x-axis. 05

Q.5 a) Prove that $\beta(m, n) = \int_0^\infty \frac{t^{m-1}}{(1+t)^{m+n}} \, dt$. 05

b) Evalute $\int_0^a \int_0^{a-x} \int_0^{a-y-x} x^2 \, dx \, dy \, dz$. 05

c) Find the RMS value of $3 \sin 2x$ over a period . 05

SECTION-**B**

Q.6 Attempt <u>any five</u> of the following 10

a) Define periodic function with example .

b) If $f(x) = \pi^2 - x^2$ over $(-\pi, \pi)$then write the value of Fourier coefficients a_0.

c) What is the half range cosine series for $f(x)$ in the interval (0, L) & Write its Fourier coefficients.

d) If $f(x) = x\ ; x \in (0,2\pi)$with period 2π find Fourier coefficients a_n.

e) Find the rank of AB if $A = \begin{bmatrix} -1 & 2 \\ 3 & 2 \end{bmatrix}$ & $B \begin{bmatrix} -1 & 1 \\ 2 & 0 \end{bmatrix}$.

f) State the condition for consistency of system of linear homegeneous equation .

g) Find the characteristic equation & Eigen value of $A = \begin{bmatrix} 9 & -7 \\ 3 & -1 \end{bmatrix}$.

h) State Cayley –Hamiltion theorem .

Q.7 a) Find the Fourier series expansion for $f(x) = \frac{\pi - x}{2}$ in the interval 0< x<2 x with period 2π. 05

b) Find the rank of matrix $A = \begin{bmatrix} 1 & 0 & -5 & 6 \\ 3 & -2 & 1 & 2 \\ 5 & -2 & -9 & 14 \\ 4 & -2 & -4 & 8 \end{bmatrix}$. 05

c) Check the consitency and solve if possible . 05

$$2x - y - 3x = 8$$
$$-x + 2y + z = 4$$
$$3x + y - 4z = 0.$$

Q.8 a) Find the Eigen value & Eigon vector for smallest Eigen value for matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ -4 & 4 & 3 \end{bmatrix}$. 05

b) Find the half range cosine series for $f(x) = x^2$in the interval $(0,\pi)$. 05

c) Express $f(x) = \frac{x\pi^2}{2}$ as Fourier series defined in $-\pi < x < \pi$. 05

Q.9 a) Verify Cayley –Hamilton theorem for matrix $A = \begin{bmatrix} 1 & 0 & -2 \\ 2 & 2 & 4 \\ 0 & 0 & 2 \end{bmatrix}$. 05

b) Find the Fourier series for $f(x) = \begin{cases} l - x & 0 < x < l \\ 0 & l < x < 2l \end{cases}$. 05

c) Check the consistancy and solve , 05

$$x + y + z = 0$$
$$2x - y - 3z = 0$$
$$3x - 5y + 4z = 0$$
$$x + 17y + 4z = 0 .$$

Q.10 a) Find the Fourier series for $f(x) = a - x^2$ in $(-a\ , a)$. 05

b) Find the nalf range series for $f(x) = \pi x - x^2$ in the interval $(0, \pi)$. 05

c) Prove that given matrix A is orthogonal if $A = \begin{bmatrix} \frac{-8}{9} & \frac{4}{9} & \frac{1}{9} \\ \frac{1}{9} & \frac{4}{9} & \frac{-8}{9} \\ \frac{4}{9} & \frac{7}{9} & \frac{4}{9} \end{bmatrix}$. 05