

Roll No.....

COURSE CODE: ENGG 202

Time: 3 hours

Max. Marks: 100

COURSE TITLE: Engineering Mathematics II

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. The rank of matrix $A = \begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$;
(a) 1 (b) 2 (c) 3 (d) None of these
- ii. e^x is periodic, with a period of
(a) 2π (b) $2\pi i$ (c) π (d) πi
- iii. The differential equation $\frac{d^2y}{dx^2} + x^2 \frac{dy}{dx} + x^3y = e^x$ is a
(a) linear differential equation of first degree (b) non-linear differential equation of first degree (c) linear differential equation of second degree (d) non-linear differential equation of second degree
- iv. The general solution of $\frac{\partial^2 z}{\partial x \partial y} = xy^2$ is
(a) $z = \frac{x^2y^2}{4} + f(y) + \varphi(x)$ (b) $z = \frac{x^3y^2}{6} + f(y) + \varphi(x)$ (c) $z = \frac{xy^3}{4} + f(y) + \varphi(x)$
(d) $z = \frac{x^2y^3}{6} + f(y) + \varphi(x)$
- v. The dimension of the vector space V_4 is
(a) 1 (b) 2 (c) 3 (d) 4
- vi. The series $\frac{1}{\log 2} - \frac{1}{\log 3} + \frac{1}{\log 4} - \frac{1}{\log 5} + \dots$ is
(a) divergent (b) absolutely convergent (c) conditionally convergent (d) convergent
- vii. The value of $\nabla \cdot \vec{r}$ is
(a) 1 (b) 2 (c) 3 (d) 4
- viii. Let A be a 3×3 matrix with rank 2; then $AX=0$ has
(a) only the trivial solution $X=0$ (b) it has one independent solution (c) it has two independent solutions (d) it has three independent solutions
- ix. The Fourier series of a odd periodic function contains only
(a) odd harmonic (b) even harmonic (c) cosine terms (d) sine terms
- x. The boundary conditions for one dimensional heat flow when the ends $x=0$ and $x=l$ are insulated are
(a) $u_x(0, t) = 0, u_x(l, t) = 0 \forall t$ (b) $u_t(l, t) = 0, u_x(0, t) = 0 \forall t$ (c) $u(0, t) = u(x, 0) = 0 \forall t$ (d) None of these



- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
- Q.2A Discuss the convergence of the series

$$\frac{1}{6} - \frac{2}{11} + \frac{3}{16} - \frac{4}{21} + \dots$$
- Q.2B Explain: (i) Torsion, and (ii) Unit bi-normal vector.
- Q.2C Write the properties of vector space. Also, define unit vector space.
- Q.2D Prove that $\nabla \times \nabla f = 0$
- Q.3A Show using a matrix that the set of vectors 05
 $X = [1, 2, -3, 4], Y = [3, -1, 2, 1], Z = [1, -5, 8, -7]$ is linearly dependent.
- Q.3B Let W be the set of all polynomials of degree not exceeding 'n' in an 05
indeterminate x , over field F . Then, W is a subspace of the vector space $F[x]$ of
all polynomial over F .
- Q.4A Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in 05
the direction of vector
 $\hat{i} + 2\hat{j} + 2\hat{k}$.
- Q.4B If f and g are solutions of the Laplace equation, then show that 05
 $\nabla \cdot (f\nabla g - g\nabla f) = 0$.
- Q.5A Find the eigen values and eigen vectors of the given matrix 05

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$
- Q.5B If $V_3(R)$ is a vector space then show that $S = \{(0, 1, -1), (1, 1, 0), (1, 0, 2)\}$ is a basis 05
of V_3 and hence find co-ordinates of vector $(1, 0, -1)$ with respect to this basis.
- Q.6A Test for absolute convergence of the series $\sum_{n=1}^{\infty} nx^{n-1}$. 05
- Q.7A Evaluate $\iiint_V f dV$ where $f = 2x + 2y$, V is the closed region bounded by the 05
cylinder $z = 4 - x^2$ and the planes $x=0, y=0, y=2$ and $z=0$.
- Q.7B Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$. Hence 10
compute A^{-1} .
- OR
- Q.7B Find the general solution of $(D^2 + a^2)y = \sec ax$ 10
- Q.8A Find the Fourier cosine series of the functions 10

$$f(x) = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 4, & 2 \leq x \leq 4 \end{cases}$$
- Q.9A Use divergence Theorem to show that 10
 $\iint_S \nabla(x^2 + y^2 + z^2) \cdot \vec{ds} = 6V$, where S is any closed surface enclosing
volume V .
- Q.9B A tightly stretched string with fixed end points $x=0$ and $x=l$ is initially in a 10
position given by $u = u_0 \sin^3(\frac{\pi x}{l})$. If it is released from rest from this position, find
the displacement $u(x, t)$.
- OR
- Q.9B Find the solution in series of $y'' + xy' + x^2y = 0$ about $x=0$. 10