2E2301

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B. Tech. II-Sem. (Back) (Back) Exam., Oct.-Nov. - 2020

MA – 102 Engineering Mathematics - II

Time: 2 Hours

Maximum Marks: 48

Min. Passing Marks: 16

Instructions to Candidates:

*Attempt any two **questions** including Question No. 1, which is compulsory. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

Q.1 Compulsory. Answer for each sub-question be given in about 25 words –

(a) State the Cayley-Hamilton theorem and use it to find the inverse of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. [2]

(b) Find the rank of matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{bmatrix}$ [2]

(c) Define linearly dependent and linearly independent vectors. [2]

(d) Find the Fourier sine series of $f(x) = x$ in the interval $0 < x < \pi$. [2]

(e) Define harmonic analysis. [2]

(f) Solve – $x\frac{dy}{dx} - y = x^4 - 3x$ [2]

(g) Solve – $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^x$ [2]

(h) Find the complete solution of partial differential equation - $pq = xy$ [2]

Q.2 (a) Find the values of λ and μ so that the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ has (i) a unique solution, (ii) no solution and (iii) an infinite number of solutions. [8]

(b) Find the eigen values and corresponding eigen vectors of the matrix

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$ [8]

Q.3 (a) Obtain the Fourier series for the function $f(x) = x + x^2; -\pi \le x \le \pi$ and hence show that - $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \cdots$ [8]

(b) The following table gives the variations of a periodic current over a period –

t(sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A(amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp. in the variable current and obtain the amplitude of the first harmonic. [8]

Q.4 (a) Solve – $(xy \sin xy + \cos xy)y\,dx + (xy \sin xy - \cos xy)x\,dy = 0$ [8]

(b) Solve – $(D^2 + 4)y = \tan 2x$ [8]

Q.5 (a) Solve – $(1 + x)^2 \frac{d^2y}{dx^2} + (1 + x)\frac{dy}{dx} + y = 4 \cos \log(1 + x)$ [8]

(b) Solve – $\cos x \frac{d^2y}{dx^2} + \sin x \frac{dy}{dx} - 2 \cos^3 xy = 2\cos^5 x$ [8]

Q.6 (a) Solve by the method of variation of parameters –

$(1 - x)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = (1 - x)^2$ [8]

(b) Solve – $(x^2 - yz)p + (y^2 - zx)q = (z^2 - xy)$ [8]

Q.7 (a) Find the complete integral by Charpit's method –

$pxy + pq + qy - yz = 0$ [8]

(b) Using the method of separation of variables, solve –

$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x, 0) = 6e^{-3x}$ [8]
