Total No. of Questions :5] [Total No. of Printed Pages :4

Roll No ....

BE-102

B.E. I & II Semester

Examination, June 2016

Engineering Mathematics - I

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Define radius of curvature and centre of curvature.

b) If $u = x^3 + y^3 + 3xy$, then find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$.

c) Find the first three terms in the expansion of $\log(1+\tan x)$ by Maclaurin's theorem.

d) Discuss the maxima or minima value of $u = f(x) = x^3 - y^2 - 7x^2 + 4y + 15x - 13$.

OR

If $u = \sec^{-1}\left(\frac{x^2+y^2}{x-y}\right)$. Find the value of

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2}.$$

2. a) Define Gamma and Beta function.

b) Evaluate $\int_1^2 x\,dx$, as the limit of a sum.

c) Evaluate the integral $\iiint xyz\,dz\,dy\,dx$,

Over the volume enclosed by three co-ordinates planes and the plane $x+y+z=1$.

d) Prove that $\Gamma(m)\Gamma\left(m+\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2^{2m-1}}\Gamma(2m)$.

OR

Change the order of integration

$$\int_0^4 \int_{x^2/4}^{2\sqrt{x}} dy\,dx.$$

3. a) Define linear and non-linear ordinary differential equation.

b) Solve $\left(x^3 + 3xy^2\right)dx + \left(3x^2y + y^3\right)dy = 0$.

c) Solve $y = 2px + y^2p^3$.

d) Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x}\sin 2x$.

OR

Solve $\frac{dx}{dt} + y = \sin t$

and $\frac{dy}{dt} + x = \cos t$.

4. a) Define rank of a matrix.

b) Find the rank of a matrix $A=\begin{bmatrix}1 & 2 & 3 & 2\\ 2 & 3 & 5 & 1\\ 1 & 3 & 4 & 5\end{bmatrix}$

c) Examine for consistency, the following equations:

$$5x+3y+14z=4,$$
$$y+2z=1,$$
$$x-y+2z=0,$$
$$2x+y+6z=2$$

d) Find Eigen values and Eigen vectors of the following matrix $A=\begin{bmatrix}2 & 2 & 1\\ 1 & 3 & 1\\ 1 & 2 & 2\end{bmatrix}$

OR

Verify Cayley-Hamilton theorem for the following matrix $A=\begin{bmatrix}1 & 2 & 3\\ 2 & 4 & 5\\ 3 & 5 & 6\end{bmatrix}$. Also find A^{-1}.

5. a) Define simple graph and tree.

b) Explain elementary concept of fuzzy logic.

c) For a Boolean algebra B, prove that $(x\cdot y'+y\cdot z)\cdot(x\cdot z+y\cdot z')=x\cdot z$

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d) Draw the switching circuit of the following Boolean function and simplified it.

$f(x,y,z)=x\cdot y\cdot z+x\cdot y'\cdot z+x'\cdot y'\cdot z$

Or

For Boolean algebra B, prove that

i) $(a+b)'=a'\cdot b'$, $\forall\, a,b\in B$

ii) $(a\cdot b)'=a'+b'$, $\forall\, a,b\in B$

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