Roll No

BE-301

B.E. III Semester

Examination, June 2016

Mathematics - II

(Common for all Branches)

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) Write Fourier series expansion of a periodic function $f(x)$ which is defined in the interval $(-l, l)$. Write Euler's formulae also.

b) Define Fourier transform and inverse Fourier transform.

c) Find the coefficient a_0 in the Fourier expansion of the even function $f(x) = |\cos x|$ in the interval $(-\pi, \pi)$.

d) Find Fourier sine transform of $\frac{e^{-ax}}{x}$.

OR

Obtain the Fourier series for the function $f(x) = x$ in the interval $(-\pi, \pi)$

2. a) Find Laplace transform of $f(t) = t^4 e^{-3t}$.

b) Evaluate $L^{-1}\left\{\frac{1}{9s^2+25}\right\}$.

c) Evaluate $L\left\{te^{-t}\sin at\right\}$.

d) Using convolution theorem, find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$.

OR

Using Laplace transform, solve the equation $(D^2 + 6D + 9)y = \sin x$, given that $y(0) = 1$ and $y'(0) = 1$

3. a) Show that $y = e^x$ is a part of complementary function of the differential equation

$$(3-x)\frac{d^2y}{dx^2}-(9-4x)\frac{dy}{dx}+(6-3x)y=0$$

b) Define ordinary point and singular point of a second order linear differential equation with variable coefficients.

c) Using method of removal of first derivative, write the normal form of the equation

$$\frac{d^2y}{dx^2}+2x\frac{dy}{dx}+\left(x^2+1\right)y=x^3+3x$$

d) Find the series solution of the equation

$$\left(1-x^2\right)\frac{d^2y}{dx^2}-x\frac{dy}{dx}+4y=0$$

OR

Using the method of variation of parameter, solve the differential equation $\frac{d^2y}{dx^2}+y=\operatorname{cosec} x$.

4. a) Derive the partial differential equation by elimination of a and b from $z=(x+a)(y+b)$.

b) Find the complete integral of the partial equation $p^2+q^2=m^2$

c) Using Lagrange's method, solve the equation $x^2p+y^2q=z^2$

d) Using Charpit's method, solve $px+qy=pq$.

OR

Solve $\frac{\partial^2 z}{\partial x^2}-2\frac{\partial^2 z}{\partial x \partial y}+\frac{\partial^2 z}{\partial y^2}=12xy$.

5. a) Find gradient of scalar function $\phi(x,y,z)=x^2+y^2-z$ at the point (1, 2, 5).

b) Define divergence of a vector point function and explain its meaning.

c) Show that a vector field given by

$\vec{A}=\left(x^2+xy^2\right)\hat{i}+\left(y+x^2y\right)\hat{j}$ is irrotational.

d) Evaluate $\int_c \vec{F}.d\vec{r}$, where $\vec{F}=x^2y^2\hat{i}+y\hat{j}$ and the curve c is $y^2=4x$ in the xy-plane from (0, 0) to (4, 4).

OR

Use Stoke's theorem to evaluate $\int_c \vec{F}.d\vec{r}$, where $\vec{F}=\left(x^2+y^2\right)\hat{i}-2xy\hat{j}$ and c is rectangle bounded by $x=\pm a$, $y=0$ and $y=b$.

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