

Roll No

BE-301

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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  $L \left\{ t e^{-t} \sin at \right\}$ .

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

OR

Using Laplace transform, solve the equation

$$(D^2 + 6D + 9)y = \sin x, \text{ given that } y(0) = 1 \text{ and } y'(0) = 1$$

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

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

- 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

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

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- d) Find the series solution of the equation

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

OR

Using the method of variation of parameter, solve the

$$\text{differential equation } \frac{d^2y}{dx^2} + y = \operatorname{cosec} x.$$

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

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

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

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

- c) Show that a vector field given by

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

- d) Evaluate  $\int_c \vec{F} \cdot d\vec{r}$ , 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  $(4, 4)$ .

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Use Stoke's theorem to evaluate  $\int_c \vec{F} \cdot d\vec{r}$ , where

$$\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j} \text{ and } c \text{ is rectangle bounded by}$$

$x = \pm a, y = 0 \text{ and } y = b.$

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