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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution under VTU, Belgaum)

Second Semester, B.E., Make – Up Examination, Jan/Feb -2014

Engineering Mathematics - II

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Note: i) Answer any ***FIVE*** *full questions, selecting atleast TWO full questions from each part.*

PART - A

1. a. Solve : $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$ 6

b. Solve : (3x − 2y+1)dy+(4y-6x − 3)dx = 0 7

c. Solve: ydx+(3x+2 − yx)dy=0 7

2 a. Solve : (x+y cos x)dx+ sin x dy = 0 6

b. Show that the system of coaxial conics

$\frac{x^2}{a^2+\lambda} + \frac{y^2}{b^2+\lambda} = 1$ is the self orthogonal where λ is the parameter. 7

c. A body originally at 100°C cools down to 70°C in 15 min, the temperature of air being 30°C. What will be the temperature of the body after 40 minutes from the original? 7

3 a. Solve : $(D^4 - 2D^3 + 2D^2 - 2D + 1)y = 0$ 6

b. Solve : $(4D^2 + 16D - 9)y = 4e^{\frac{x}{2}} + 3\sin\left(\frac{x}{4}\right)$ 7

c. Solve :$(D^2 - D)\, y = (1+x^2)e^x$ 7

4 a. Solve by the method of undetermined coefficients : $y'' - 4y' + 4y = e^x$ 6

b. Solve: $y'' + y = \operatorname{cosec} x$ by the method of variation of parameters. 7

c. Solve : $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = (1+x)^2$ 7

PART - B

5 a. Find the Laplace transform of :

(i) $\left(\sqrt{t} + \frac{1}{\sqrt{t}}\right)^3$ (ii) $\cosh at \sin at$ 6

b. If $f(t) = \begin{cases} t; & 0 \le t \le a \\ 2a - t & a \le t \le 2a \end{cases}$, f(t+2a) = f(t) show that $L\{f(t)\} = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$ 7

c. Express $f(t)=\begin{cases}1, & 0<t\le 1\\ t, & 1<t\le 2\\ t^2, & t>2\end{cases}$ 7

In terms of unit step function and hence find its Laplace transform.

6. a Find the inverse Laplace transform of :
$\frac{1}{3s-2}+\frac{4}{5s+1}+\frac{1}{s\sqrt{s}}$ 6

b. Apply convolution theorem to evaluate $L^{-1}\left\{\frac{s}{\left(s^2+a^2\right)^2}\right\}$ 7

c. Solve using Laplace transforms:
$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^t\sin t$ where y(0) = 0, y'(0) = 1. 7

7 a. Find the angle between the tangents to the curve $\vec{r}=t^2\hat{i}+2tj-t^3\hat{k}$ at the point $t=\pm 1$. 6

b. Find the constants *a*, *b*, *c* so that the vector

$\vec{F}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x-cy+2z)\hat{k}$ is irrational. Also find the scalar field 7

ϕ such that $F=\nabla f$

c. In which direction the directional derivative of the function $x^2y^2z^3$ is maximum at the point (1,-1, 2)? Find the magnitude of this maximum. 7

8 a. Using Green's theorem in a plane, evaluate

$\oint_C \left\{\left(2x^2-y^2\right)dx+\left(x^2+y^2\right)dy\right\}$, where C is the boundary of the region bounded by $x=0$, $y=0$, $x+y=1$. 6

b. Apply Stoke's theorem to evaluate :

$\oint_c (x+y)dx+(2x-z)dy+(y+z)dz$ where C is t he boundary of the triangle with vertices (0,0,0), (2,0,0) and (0,3,0) 7

c. Express the vector $\vec{F}=2x\hat{i}-3y^2\hat{j}+xz\hat{k}$ in cylindrical polar coordinate system. 7

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