Paper / Subject Code: FE211 / Applied Mathematics-II

FE211

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F. E. Semester-II (Revised Course 2007-2008) EXAMINATION MAY/JUNE 2019
Applied Mathematics-II

[Duration : Three Hours] **[Max. Marks : 100]**

Please check whether you have got the right question paper.

Instructions :
1. Attempt **any five** questions, at least one from each module.
2. Assume suitable data if necessary

MODULE-I

Q.1 a) Evaluate $\int_0^{\infty} \frac{\log_e(1+\alpha t^2)\,dt}{t^2}$ by applying differentiation under the integral sign. **08**

b) Find the length of $y = 2x^{3/2} + 1 \quad 1 \le x \le 3$ **06**

c) Find the perimeter of the cardiode $r = a\,(1+\cos\theta)$ **06**

Q.2 a) Find the unit tangent vector, and principal normal of the space curve $\bar{r}(t) = 2t^3\bar{\imath} + 2t\,\bar{\jmath} + (t+2)\bar{k}$ at t=1. **06**

b) Define Curvature and Torsion of a space curve and prove Serret – Frenet formula. **08**

c) Solve $\frac{d\bar{r}^2}{dt^2} = 2\bar{\imath} - 3\bar{k}, \bar{r}(0) = \bar{2\imath} - \bar{\jmath}$ and $\frac{d\bar{r}}{dt}|_{t=0} = \bar{k}$ **06**

MODULE-II

Q.3 a) Evaluate $\int_0^1 \int_y^1 2x + 1dxdy$. **05**

b) Change the order of integration and evaluate $\int_0^1 \int_{x^2}^{x} y + 3dxdy$ **08**

c) Evaluate $\int\int r^2 + 3\,\sin\theta\, drd\theta$ over the region $r \le 1$ above the initial line. **07**

Q.4 a) Find by double integration the volume of the solid generated by the revolution of the region $y^2 \le x$ and $x \le 1$ about the x-axis. **06**

b) Evaluate $\int_{-1}^{1} \int_0^x \int_0^{(x+y)} 2x\, dzdydx$ **06**

c) Find the volume of the region$\{(x,y,z)/x^2 + y^2 \le 4, 0 \le z \le 1, y \ge 0\}$. **08**

MODULE-III

Q.5 a) If $\bar{f}(t)$ is a vector field having constant magnitude show that $\bar{f}(t) \bullet \frac{d}{dt}(\bar{f}(t))=0$ **05**

b) Define Curl of a vector field. Show that if $\bar{a}$ is any constant vector and $\bar{r} = x\bar{\imath} + y\bar{\jmath} + z\bar{k}$ then show that $curl\ (\bar{a} \times \bar{r}) = 2\bar{a}$. **05**

c) In what direction is the directional derivative of $f(x, y, z) = x^2z + 2xy$ at the point (-1,2,1) maximum and what is its magnitude? **05**

d) Show that the vector field $\bar{F} = (6xy + 3z)\bar{\imath} + 3x^2\bar{\jmath} + (6z + 3x)\bar{k}$ is irrational find its scalar potential. **05**

Q.6 a) Find the work done in moving a particle in a force field $\bar{F} = 3y^2\ \bar{\imath} + 2y\bar{\jmath} + xz\bar{k}$ along the curve $x = 3t, y = 2t^2, z = 2t\ from\ t = 0\ to\ t = 1$. **06**

b) Verify Green theorem in the plane for $\oint c(x + 3y^2)dx + (x^2 + 2)dy$ where C is the boundary of the region bounded by y=x, x=1 and y=0 **08**

c) Use Stoke's theorem to evaluate $\int\int_S \nabla \times F.\bar{n}ds$ where $F = x^2z\,\bar{\imath} + x^2\bar{\jmath} + y^2\bar{k}$ $\bar{n}$ is the unit normal vector to S, the surface of the region bounded by **06**

$x = 0, y = 0, z = 0\ and\ x + y + z = 1$excluding the surface in the xy plane

MODULE-IV

Q.7 Solve the following differential equations. **20**

a) $\frac{dy}{dx} = e^{x-2y} + xe^{-2y}$

b) $(x + 2y\ cosx)dx + (y + 2\sin x)dy = 0$

c) $\frac{dy}{dx} = \frac{2y-x-4}{y-3x+3}$

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

Q.8 Solve the following differential equations **20**

a) $(D^2 + 3D + 2)y = 4e^{-3x}$

b) $(D^2 + 4)y = 2\ \text{Cos}^2\,x$

c) $(D^2 + 4D + 4)y = 2Sinh2x$

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