F.E. Nov-Dec. 2011
Sem. II 2008 pattern

Total No. of Questions : 12] [Total No. of Printed Pages : 7

[4061]-107

F. E. Examination - 2011

ENGINEERING MATHEMATICS - II

(2008 Pattern)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

(1) In section I, attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6.

In section II, attempt Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12.

*(2) Answers to the **two sections** should be written in **separate answer-books.***

(3) Black figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Form the differential equation by eliminating the arbitrary constants from the equation :

$y = e^x (A\cos x + B\sin x)$ **[06]**

(B) Solve the following differential equations : **(Any Two)** **[10]**

(a) $\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right)\frac{dx}{dy} = 1$

(b) $(3y + 2x + 4)\,dx - (4x + 6y + 5)\,dy = 0$

(c) $(1 + xy)\,ydx + (1 - xy)\,xdy = 0$

OR

Q.2) (A) Form the differential equation by eliminating the arbitrary constants from the equation :

$$xy = Ae^{x} + Be^{-x} + x^{2}$$ **[06]**

(B) Solve the following differential equations : **(Any Two)** **[10]**

(a) $\frac{dy}{dx} + \tan x \tan y = \cos x \sec y$

(b) $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y\cos y}$

(c) $(xy^3 + y)\,dx + 2(x^2y^2 + x + y^4)\,dy = 0$

Q.3) Attempt the following : **(Any Three)** **[18]**

(a) Find the orthogonal trajectories of $ay^2 = x^3$.

(b) A body originally at 80°C cools down to 60°C in 20 minutes, the temperature of the air being 40°C. What will be the temperature of the body after 40 minutes ?

(c) The current in the circuit containing an inductance L, resistance R and voltage Esinwt is given by $L\frac{di}{dt} + Ri = E\sin wt$. If initially there is no current in the circuit, find the current in the circuit at time t.

(d) A particle executing SHM has velocities 8cm/sec and 6cm/sec, when it is at distances 3cm and 4cm respectively from the centre of its path. Find its Period and Amplitude.

OR

Q.4) Attempt the following : **(Any Three)** **[18]**

(a) A circuit consisting of a resistance R and inductance L is connected in series with a voltage E. Given i = 0 at t = 0. Show that the current builds up to half its maximum value in $\frac{L(\log 2)}{R}$ seconds.

(b) In a culture of yeast, at each instant, the time rate of change of active ferment is proportional to the amount present. If the active ferment doubles in two hours, how much can be expected at the end of 8 hours at the same rate of growth ?

(c) A body of mass m falling from rest is subjected to the force of gravity and an air resistance proportional to the square of the velocity (kv^2). If it falls through a distance x and possesses a velocity v at that instant, prove that $\frac{2kx}{m} = \log\left(\frac{a^2}{a^2 - v^2}\right)$ where $mg = ka^2$.

(d) A long hollow pipe has an inner diameter of 10cm and outer diameter of 20cm. The inner surface is kept at 200°C and outer surface at 50°C. The thermal conductivity is 0.12. Find the temperature at a distance x = 7.5cm from the centre of pipe.

Q.5) (A) The turning moment T units of the crank shaft of a steam engine is given for a series of values of the crank angle θ in degrees :

θ°	0	30	60	90	120	150	180
T	0	5224	8097	7850	5499	2626	0

Find the first three terms in a series of sines to represent T. Also calculate T when $\theta = 75^\circ$. **[07]**

(B) If $I_n = \int_0^\infty e^{-x} \sin^n x \, dx$.

Obtain a relation between I_n and I_{n-2}. **[05]**

(C) Evaluate : $\int_0^1 (x \log x)^4 \, dx$ **[04]**

OR