BT MRE – I & II – 09 – 03

# *B. Tech Degree I & II Semester Examination in Marine Engineering, May 2009*

## MRE 103 ENGINEERING PHYSICS

Time : 3 Hours | Maximum Marks : 100

I. (a) Obtain the conditions of interference of light transmitted from a thin transparent film. (7)
(b) Explain the theory of Newton's rings by reflected light. (10)
(c) A parallel beam of light with wavelength 5890 $\mathring{A}$ is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is $60^\circ$. Calculate the smallest thickness of the glass plate which will appear dark by reflection. (3)

**OR**

II. (a) Newton's rings are observed in reflected light of wavelength 5900 $\mathring{A}$. The diameter of $10^{th}$ dark ring is 0.50 cm. Find the radius of curvature of the lens and the thickness of the air film. (7)
(b) Discuss the phenomenon of interference of light with respect to air wedge formed between two glass plates. (6)
(c) Newton's rings are formed with reflected light of wavelength $5.895 \times 10^{-5}$ cm with a liquid between the plane and the curved surface. The diameter of the $5^{th}$ dark ring is 0.3 cm and the radius of curvature of the curved surface is 100 cm. Calculate the refractive index of the liquid. (7)

III. (a) What is Zone plate? Obtain the expression for its focal length. (8)
(b) Explain Rayleigh's criterion of resolution and discuss the difference between dispersive power and resolving power of grating. (10)
(c) A parallel beam of sodium light is allowed to be incident normally on a plane grating having 4250 lines per cm and a second order spectral line is observed to be deviated through $30^\circ$. Calculate the wavelength of spectral line. (2)

**OR**

IV. (a) Explain the construction and propagation of light through Nicol prism. (8)
(b) State Huygen's theory of double refraction. Calculate the thickness of a quarter wave plate when beam of light with wavelength 5000 $\mathring{A}$ is incident on it. The refractive indices of plate for ordinary and extraordinary rays are 1.544 and 1.533 respectively. (6)
(c) Discuss the production of circularly polarised light. (6)

V. (a) Explain the construction and working of Ruby laser. (10)
(b) Discuss the principle which dictates the emission of laser beam. (5)
(c) State the different processes which give rise to total loss of the system during laser emission. (5)

**OR**

VI. (a) Explain the construction and working of Helium-Neon laser. (10)
(b) Discuss the applications of Holography. (6)

*(Turn Over)*

(c) Describe the variable density method for recording of sound on cine films. (4)

VII. (a) What is Optical fiber? Explain the phenomenon which dictates the propagation of light through it. (3)

(b) Obtain the expression for Numerical Aperture of step index fiber. (10)

(c) Distinguish between single mode step index fiber and graded index fibers. (7)

**OR**

VIII. (a) Consider a step index fiber in air. The refractive index of air is 1. The refractive index of core and cladding are 1.53 and 1.50 respectively. Calculate the fiber acceptance angle and Numerical Aperture of the fiber. (6)

(b) Describe with block diagram, the aspects relating to Optical Communication process. (8)

(c) What are the advantages of Optical Communication process? (6)

IX. (a) What is Magnetostriction Effect? Describe magnetostriction method of producing ultrasonics? (8)

(b) Discuss the application of ultrasonics in detecting flaws in metals. (8)

(c) Discuss the applications of superconductivity. (4)

**OR**

X. (a) Explain the effect of magnetic field on Type II superconductors. (5)

(b) Explain Meissner effect and isotopic effect. (9)

(c) Discuss a.c and d.c Josephson effect. (6)

***

BT MRE – I & II – 09 – 02

# B. Tech Degree I & II Semester Examination in Marine Engineering, May 2009

## MRE 102 ENGINEERING MATHEMATICS II

Time : 3 Hours Maximum Marks : 100

I. (a) Find the value of $\lambda$ for which the equations
$(2-\lambda)x+2y+3=0, 2x+(4-\lambda)y+7=0,\ 2x+5y+(6-\lambda)=0$
are consistent. (7)

(b) Find the eigen values and eigen vectors of the matrix $A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$ (13)

**OR**

II. (a) Prove that the function $\sinh z$ is analytic and find its derivative. (10)

(b) Expand $\frac{1}{z^2-3z+2}$ in the region $|z|<|$ (10)

III. (a) Solve :

(i) $(xy^2+x)dx+(yx^2+y)dy=0$ (5)

(ii) $(x+1)\frac{dy}{dx}-y=e^{3x}(x+1)^2$ (5)

(b) Find the orthogonal trajectory of the cardioids $r=a(1-\cos\theta)$. (10)

**OR**

IV. Solve :

(i) $(D-2)^2 y=8(e^{2x}+\sin 2x+x^2)$ (10)

(ii) $\frac{d^2y}{dx^2}+a^2y=\sec ax$ (10)

V. (a) Obtain the Fourier series to represent $f(x)=\frac{1}{4}(\pi-x)^2, 0<x<2\pi$. (12)

(b) Expand $f(x)=x^2-2$ as a Fourier series in the interval $(-2,2)$. (8)

**OR**

*(Turn Over)*

VI. (a) Express the function $f(x)=\begin{cases}1 \text{ for } |x|\le 1\\ 0 \text{ for } |x|>1\end{cases}$ as a Fourier integral.

Hence evaluate $\int_o^\infty \frac{\sin\lambda cos\lambda x}{\lambda}d\lambda$ (10)

(b) Show that $\beta(p,q)=\int_o^\infty \frac{y^{q-1}}{(1+y)^{p+q}}dy=\int_o^1 \frac{x^{p-1}+x^{q-1}}{(1+x)^{p+q}}dx$ (10)

VII. (a) Find the Laplace Transform of (i) $e^{-3t}(\cos 4t+3\sin 4t)$ (ii) $t\sin^2 3t$ (10)

(b) Find the inverse Laplace transform of (i) $\frac{2s^2-4}{(s+1)(s-2)(s-3)}$ (ii) $\frac{4s+15}{16s^2-25}$ (10)

**OR**

VIII. (a) Apply convolution theorem to evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$ (8)

(b) Solve the equation by transform method

$$y''-3y'+2y=4t+e^{3t}, \text{ when } y(0)=1 \text{ and } y'(0)=-1$$ (12)

IX. (a) A bag contains 7 white, 6 red and 5 black balls. Two balls are drawn at random. Find the probability that they will both be white. (6)

(b) A can hit a target 4 times in 5 shots; B 3 times in 4 shots, C twice in 3 shots. They fire a volley. What is the probability that at least two shots hit? (10)

(c) State Baye's theorem. (4)

**OR** .

X. (a) A die is tossed thrice. A success is getting 1 or 6 on a toss. Find the mean and variance of the number of successes. (8)

(b) If $X$ is a Poisson variate such that $P(X=2)=9P(X=4)+90P(X=6)$.

Find the standard deviation. (6)

(c) Define Normal distribution and list its basic properties. (6)

***

BT MRE – I&II – 09 – 01

# B.Tech Degree I & II Semester Examination in Marine Engineering, May 2009

## MRE 101 ENGINEERING MATHEMATICS I

Time : 3 Hours | Maximum Marks : 100

(All questions carry ***EQUAL*** marks)

I. (a) Verify Roll's theorem for the function $f(x) = \frac{Sin\,x}{e^x} in [0, \pi]$. (6)

(b) Evaluate $\lim_{x \to 0} \left( \frac{1}{Sin\,x} - \frac{1}{x} \right)$. (7)

(c) Find the radius of curvature of the cycloid $x = a(\theta + Sin\,\theta); y = a(1 - Cos\theta)$. (7)

**OR**

II. (a) Find the asymptotes of the curve

$$2x^3 - x^2y - 2xy^2 + y^3 + 2x^2 + xy - y^2x + y + 1 = 0.$$ (8)

(b) If $y = e^{a Sin^{-1} x}$, prove that $(1 - x^2) y_{n+2} - (2n+1) x y_{n+1} - (n^2 + a^2) y_n = 0$. (12)

III. (a) Given that $u = Sin(x^2 + y^2)$ where $x = 3t$ and $y = \frac{1}{1+t^2}$, determine $\frac{du}{dt}$. (7)

(b) Verify Euler's theorem for the function $u = x^n Sin \frac{y}{x}$. (6)

(c) The power $P$ required to propel a steamer of length $l$ at a speed $u$ is given by $P = \lambda u^3 l^2$, where $\lambda$ is a constant. If $u$ is increased by 3% and $\ell$ is decreased by 1%, find the corresponding increase in $P$. (7)

**OR**

IV. (a) If $u = x^2 - y^2$ and $v = 2xy$ prove that $\frac{\partial(x,y)}{\partial(u,v)} = \frac{1}{4\sqrt{u^2 + v^2}}$. (6)

(b) Prove that $u = x^3 + y^3 - 3axy$ is maximum or minimum at $x = y = a$ according as $a$ is negative or positive. (7)

(c) If $u = Sin^{-1} \frac{x^2 + y^2}{x + y}$, show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$. (7)

V. (a) Find the co-ordinates of the centre, foci and equation to the directrices of the ellipse $9x^2 + 25y^2 - 18x - 100y + 116 = 0$. (6)

(b) Find the equation to the parabola whose focus is the point $(3,4)$ and directrix is the straight line $2x - 3y + 5 = 0$. (6)

(c) The asymptotes of a hyperbola are parallel to 2x+3y=0 and 3x – 2y = 0. Its centre is at $(1,2)$ and it passes through the point $(5,3)$. Find its equation. (8)

**OR**

***(Turn Over)***

VI. (a) Find the condition that the straight line $Px + my + n = 0$ may be a normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (7)

(b) Show that the locus of the point of intersection of two perpendicular tangents to a parabola is its direction. (6)

(c) Prove that the tangent to a rectangular hyperbola terminated by its asymptotes is bisected at the point of contact and encloses a triangle of constant area. (7)

VII. (a) Using the double integral, find the area lying between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. (10)

(b) Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dydx}{1+x^2+y^2}$. (10)

**OR**

VIII. (a) Find the area of the surface of revolution formed by revolving the loop of the curve $9ay^2 = x(3a-x)^2$ about $x$ - axis. (10)

(b) Change the order of integration and their evaluate :

$$I = \int_0^a \int_{\sqrt{(ax)}}^a \frac{y^2 dy\, dx}{\sqrt{\left(y^4 - a^2x^2\right)}}.$$ (10)

IX. (a) Show that the vectors $\vec{a} - 2\vec{b} + 3\vec{c}, -2\vec{a} + 3\vec{b} - 4\vec{c}, -\vec{b} + 2\vec{c}$ are coplanar. (6)

(b) Is any triangle ABC, prove that $c^2 = a^2 + b^2 - 2ab\,Cos\,C$. (6)

(c) Given $\vec{a} = 2\hat{i} + 2\hat{j} - \hat{k}, \vec{b} = 6\hat{i} - 3\hat{j} + 2\hat{k}$, find $\vec{a} \times \vec{b}$ and a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$. Also determine the Sine of the angle between $\vec{a}$ and $\vec{b}$. (8)

**OR**

X. (a) Prove that $\left[\vec{b} \times \vec{c}, \vec{c} \times \vec{a}, \vec{a} \times \vec{b}\right] = \left[\vec{a}\ \vec{b}\ \vec{c}\right]^2$. (6)

(b) Find the divergence and eurl of the vector $\vec{V} = (xyz)\hat{i} + (3x^2y)\hat{j} + (xz^2 - y^2z)\hat{k}$ at the point $(2,-1,1)$. (6)

(c) Prove that div $\left(\frac{\vec{r}}{r^3}\right) = 0$ where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$. (8)

***