

23/05/17

FE-sem-II

02

Q.P. Code:16951

( OLD COURSE )

( 2 Hours )

[ Total Marks : 75 ]

- N.B : (1) Question No.1 is compulsory.  
 (2) Solve any four questions from Q.2 to Q.7.  
 (3) Symbols have their usual meanings.  
 (4) Assume suitable data wherever necessary.  
 (5) Figures to the right indicate full marks.

1. Answer any Five from the following :

15

- Find out similarities and dissimilarities between Newton's ring and wedge shaped films.
- Define terms i) Total Internal Reflection ii) Numerical Aperture (NA) iii) Acceptance angle.
- Explain metastable state and pumping for Laser system.
- Find the energy of the neutrons in units of electron volt whose de Broglie wavelength is  $1 \text{ \AA}$ .  
 (Given :  $m_n = 1.674 \times 10^{-27} \text{ kg}$  and  $h = 6.62 \times 10^{-34} \text{ J-Sec}$ )
- Differentiate between soft and hard magnetic materials.
- A magnetic material has magnetizing force  $198 \text{ A/m}$  and magnetization of  $2300 \text{ A/m}$ .  
 Find (a) corresponding flux density (b) Relative permeability.
- Explain Pirani Gauge.

2. (a) What does the word LASER stand for ? Explain the following terms related to LASER with appropriate Figures (i) Absorption (ii) Spontaneous emission (iii) stimulated emission. 7

(b) What is the significance of vacuum Technology. Hence explain the construction and working of Rotary pump. 8

3. (a) Describe fibre optics communication system with block diagram. 7

(b) With neat energy level diagram describe the construction and working of He - Ne laser. 8

4. (a) In Newton's ring experiment the diameter of 4<sup>th</sup> and 12<sup>th</sup> dark rings are  $0.400 \text{ cm}$  and  $0.700 \text{ cm}$  respectively. Deduce the diameter of 20<sup>th</sup> ring. 5

(b) Explain de- Broglie's hypothesis. 5

(c) A ring of 2 meter mean circumference of cross-sectional area  $60 \text{ cm}^2$  is taken. If relative permeability of the medium is 900 and number of turns are 700, then calculate current required to produce a flux of  $5.9 \times 10^{-3} \text{ weber}$ . 5

5. (a) How many orders will be visible if the wavelength of incident radiation is  $5000 \text{ \AA}$  and the number of lines on the grating is 2620 to an inch. 5

(b) Show that the energy of an electron in the box varies as the square of natural numbers. 5

(c) Explain the principle and construction of SEM. 5

6. (a) Write a note on the diffraction of light rays through a diffraction grating. 5

(b) Derive one dimensional time dependent Schrodinger equation for matter waves. 5

(c) Write a note on STM ( Scanning Tunnelling Microscope ). 5

7. (a) How Newton's ring experiment is useful to determine refractive index of liquid medium ? Explain. 5

(b) Explain holography as an application of Laser. 5

(c) Explain various stages of Hysteresis curve. 5



## Applied Mathematics - II

Q. P. Code: 16071

Time: (03) hours

Total Marks: 100

N.B. (i) Question no. ONE is compulsory.

(ii) Attempt any FOUR questions from remaining six questions.

(iii) Figures to right indicate full marks.

Q. 1 (a) Evaluate

$$\int_0^{\pi/6} \cos^3 3\theta \sin^2 6\theta d\theta$$

3

(b) Solve

$$\frac{d^3 y}{dx^3} + 2 \frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} - 6y = 0$$

3

(c) Evaluate

$$\int_{-1}^1 \int_0^x \int_{-z}^z (x+y+z) dy dx dz$$

3

(d) Evaluate

$$\int_1^2 \int_0^x \frac{1}{x^2 + y^2} dy dx$$

3

(e) Solve  $(2x^2 + 3y^2 - 7)xdx + (3x^2 + 2y^2 - 8)ydy = 0$ 

4

(f) Using Euler's method find the approximate value of  $y$  where

$$\frac{dy}{dx} = x + 2y, y(1) = 1 \text{ taking } h = 0.2 \text{ at } x = 2$$

4

Q. 2 (a) Evaluate

$$\int_0^{\pi/2} \int_0^1 \sin \theta r^2 \cos \theta dr d\theta$$

6

(b) Evaluate  $\iiint (x + y + z) dx dy dz$  over the tetrahedron bounded by the planes  $x = 0, y = 0, z = 0$  and  $x + y + z = 1$ 

6

(c) Show that

$$\int_0^{\infty} \frac{\tan^{-1}(x/a) - \tan^{-1}(x/b)}{x} dx = \frac{\pi}{2} \log \left( \frac{b}{a} \right) \text{ where } a > 0, b > a$$

8

Q. 3 (a) Solve

$$\tan y \frac{dy}{dx} + \tan x = \cos y \cos^3 x$$

6

[TURN OVER]



(2)

- (b) Find by double integration the area between the curves

$$y^2 = 4x \text{ and } 2x - 3y + 4 = 0$$

- © Solve

$$\frac{d^2y}{dx^2} + 9y = e^x - \cos 2x$$

- Q.4 (a) Solve

$$(4xy + 3y^2 - x)dx + x(x + 2y)dy = 0$$

- (b) Change the order of integration and evaluate

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{e^y}{(e^y + 1)\sqrt{1-x^2-y^2}} dy dx$$

- © Using Taylor's series method solve the differential equation

$$\frac{dy}{dx} = x + y, \text{ start from } x = 1, y = 0 \text{ and carry to } x = 1.2 \text{ with } h = 0.1$$

- Q.5 (a) Find the length of one arc of the cycloid
- $x = a(\theta - \sin \theta), y = a(1 + \cos \theta)$

- (b) Find the volume bounded by the cylinder
- $x^2 + y^2 = a^2$
- and the planes
- $z = 0$
- and
- $y + z = b$

- © Solve numerically using Runge - Kutta Method of Fourth order the differential equation
- $\frac{dy}{dx} = xy$
- with initial conditions
- $y(1) = 1$
- at
- $x = 1.2$

taking  $h = 0.1$ 

- Q.6 (a) Evaluate

$$\int_0^1 x^{q-1} \left( \log \frac{1}{x} \right)^{p-1} dx$$

- (b) Evaluate

$$\iint (x^2 - y^2) dx dy \text{ over the positive quadrant of the circle } x^2 + y^2 = a^2$$

[TURN OVER]



(3)

- (c) Solve by method of variation of parameters  $(D^2 + a^2)y = \sec ax$  8

Q.7 (a) Evaluate

$$\int_0^1 x^6 (1-x^2)^{1/2} dx$$

- (b) Change to polar coordinates and evaluate  $\int_0^a \int_0^a x dx dy$  6

- (c) The charge  $q$  on the plate of a condenser of capacity  $C$  charged through a resistance  $R$  by a steady voltage  $V$  satisfies the differential equation  $R \frac{dq}{dt} + \frac{q}{C} = V$ . If  $q = 0$  at  $t = 0$ , show that  $q = CV(1 - e^{-t/RC})$ . Find also the current flowing into the plate. 8

AC-II FE Sem II (Old)

29/5/17

Q.P. Code :13030

[Time: 2:00 Hours]

[ Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. Question No. 1 is compulsory.
  2. Attempt any four questions from the remaining six.
  3. Figures to the right indicate full marks.
  4. Atomic weight :- H =1 , C=12, N= 14, O=16, S=32 , Na=23, Ca=40 , Mg =24  
Cl =35.5 , Ba =137.3

(2)

- Q.1 Answer any five from the following:- 15
- a) Why silver, gold and platinum do not undergo oxidation corrosion?
  - b) Define fuels. Classify fuel with suitable examples.
  - c) Give the composition, properties and uses of Duralumin.
  - d) State the characteristics of a good paints.
  - e) Give the classification of composite material.
  - f) 1.4gm of a coal sample was taken for nitrogen estimation by Kjeldahl's method. The ammonia liberated required 9.2 ml of 0.4N.  $H_2SO_4$  for neutralization. The same sample of coal weighing 1.4gm in Bomb's calorimeter experiment produced 0.30 gm of  $BaSO_4$ . Calculate the percentage of N and S.
  - g) Define catalysis. Explain different types of catalysis with one example each.
- Q.2 a) Discuss the effect of the following factors on the rate of corrosion. 06
- i. Relative area of the anode and cathode
  - ii. pH
  - iii. Over voltage.
- b) What is powder metallurgy? How are metal powders prepared? 05
- c) Calculate the gross and net calorific value of coal having following composition. 04  
C=80% , H=7% , O=3% , S=3.5% , N=2.0% , ash = 4.5%
- Q.3 a) What is cracking? Discuss the fixed bed catalytic cracking method in detail. 06
- b) Write a note on structural composites. 05
- c) Calculate the percentage atom economy for the following reaction. 04
- $$C_6H_6 + CH_3Cl \xrightarrow{AlCl_3} C_6H_5CH_3 + HCl$$
- Q.4 a) What is corrosion? Explain the mechanism of electrochemical corrosion with absorption of oxygen. 06
- b) Explain the adsorption theory of heterogeneous catalysis. 05
- c) Give conventional and green chemistry route of production of Adipic acid. 04



Q.P. Code :13030

- Q.5 a) A gas has the following composition by volume:- 06  
 $\text{CH}_4=40\%$  ,  $\text{C}_2\text{H}_6=20\%$  ,  $\text{C}_3\text{H}_8=10\%$  ,  $\text{H}_2=10\%$  ,  $\text{CO}=9\%$  ,  $\text{N}_2=11\%$   
Calculate weight and volume of air required per  $\text{m}^3$  of gas (mol.wt of air =28.94)
- b) What is cathodic protection? Describe sacrificial anode method for corrosion control. 05
- c) List the principles of green chemistry. 04
- Q.6 a) What are alloys? What is the purpose of making alloy? Explain with examples. 06
- b) Explain Differential aeration corrosion with suitable example. 05
- c) Explain octane number and cetane number. 04
- Q.7 a) What are metal ceramic powder? Give the methods of ceramic powder formation. 06
- b) Discuss the electroplating method of applying metallic coating in detail. 05
- c) Define the following terms: 04  
i) Atomization  
ii) Sintering.