20/11/2017   (13)

F.E Sem-II, (Choice Based Course)   Q.P. Code :16282

Max. Marks: 80   Time: 3 hrs.

N.B. : 1. Q1 is compulsory
       2. Attempt any three questions from Q2 to Q6.

Q1. a) Evaluate $\int_{0}^{\infty} \dfrac{e^{-x^2}}{\sqrt{x}}\,dx$ 3

b) Solve $\left(D^3 + 1\right)^2 y = 0$ 3

c) Solve the ODE $\left(y + \dfrac{1}{3}y^3 + \dfrac{1}{2}x^2\right)dx + \dfrac{1}{4}\left(x + x y^2\right)dy = 0$ 3

d) Use Taylor's series method to find a solution of $\dfrac{dy}{dx} = 1 + y^2$, $y(0) = 0$ 3
at $x = 0.1$ taking $h = 0.1$ correct to three decimal value.

e) Given $\int_{0}^{x} \dfrac{dx}{x^2 + a^2} = \dfrac{1}{a}\tan^{-1}\left(\dfrac{x}{a}\right)$, using DUIS find the value of $\int_{0}^{x} \dfrac{dx}{\left(x^2 + a^2\right)^2}$ 4

f) Find the perimeter of the curve $r = a(1 - \cos\theta)$ 4

Q2. a) Solve $\left(D^3 + D^2 + D + 1\right)y = \sin^2 x$ 6

b) Change the order of integration $\int_{0}^{a}\int_{\sqrt{a^2-x^2}}^{x+3a} f(x,y)\,dx\,dy$ 6

c) Evaluate $\iint_{R} \dfrac{2x \cdot y^3}{\sqrt{1 + x^2 y^2 - y^4}}\,dx\,dy$, where R is a triangle whose vertices   8
are $(0,0),(1,1),(0,1)$.

Q3. a) Find the volume enclosed by the cylinder $y^2 = x$ & $y = x^2$ 6
cut off by the planes $z = 0$, $x + y + z = 2$.

b) Using Modified Euler's method, find an approximate value of y at   6
$x = 0.2$ in two step taking $h = 0.1$ and using three iteration, given that
$\dfrac{dy}{dx} = x + 3y$, $y = 1$ when $x = 0$.

c) Solve $(1+x)^2 \dfrac{d^2 y}{dx^2} + (1+x)\dfrac{dy}{dx} + y = 4\cos\log(1+x)$ 8

Q4. a) Show that $\int_{0}^{a}\sqrt{\dfrac{x^3}{a^3 - x^3}}\,dx = \dfrac{a\sqrt{\pi}\,\Gamma\left(\tfrac{5}{6}\right)}{\Gamma\left(\tfrac{1}{3}\right)}$ 6

b) Solve $\left(D^2 + 2\right)y = e^x \cos x + x^2 e^{3x}$ 6

c) Use polar co-ordinates to evaluate $\iint \dfrac{\left(x^2 + y^2\right)^2}{x^2\, y^2}\, dx\, dy$ over the area   **8**

common to the circle $x^2 + y^2 = ax$ and $x^2 + y^2 = by$, $a > b > 0$.

Q5. a) Solve $y\, dx + x\left(1 - 3\, x^2\, y^2\right) dy = 0$ **6**

b) Find the mass of a lamina in the form of an ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$, if the   **6**

density at any point varies as the product of the distance from the axes of the ellipse.

c) Compute the value of $\displaystyle\int_{0}^{\pi/2} \sqrt{\sin x + \cos x}\ dx$ using (i) Trapezoidal rule   **8**

(ii) Simpson's $(1/3)^{rd}$ rule (iii) Simpson's $(3/8)^{th}$ rule by dividing into six subintervals.

Q6. a) Evaluate $\displaystyle\iiint_{V} x^2\ dx\, dy\, dz$ over the volume bounded by the planes   **6**

$x = 0,\ y = 0,\ z = 0$ and $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$

b) Change the order of integration and evaluate $\displaystyle\int_{0}^{4}\int_{\sqrt{2x}}^{\sqrt{x^2 - 4 y^2}} \dfrac{x^2}{\sqrt{x^2 - 4 y^2}}\, dx\, dy$ **6**

c) Solve by the method of variation of parameters $\dfrac{d^2 y}{dx^2} - 6 \dfrac{dy}{dx} + 9 y = \dfrac{e^{3x}}{x^2}$ **8**

Sem-II F.E, (CBSGS)   20/11/2017   Q. P. Code : 22297

Duration – 3 Hours   **Total Marks : 80**

(1) N.B.:- Question no 1 is compulsory.
(2) Attempt any THREE questions out of remaining FIVE questions.

Q.1) a) Solve $\dfrac{dy}{dx} = \dfrac{a^2 - 2xy - y^2}{(x+y)^2}$ (4)

b) *Solve* $(D^3 - 3D^2 + 4)y = 0$ (3)

c) Evaluate $\displaystyle\int_0^\infty e^{-\left(x^2/4\right)}\, dx$ (3)

d) Express the following integral in polar co-ordinate (4)

$$\int_0^{2a}\int_0^{\sqrt{2ax-x^2}} f(x,y)\, dx\ dy$$

e) Prove that $E = 1 + \Delta = e^{hD}$ (3)

f) Evaluate $I = \displaystyle\int_0^{\pi/2}\int_{\pi/2}^{\pi} \cos(x+y)\, dy\ dx$ (3)

Q.2 a) Solve $\dfrac{dz}{dx} + \dfrac{z}{x}\log z = \dfrac{z}{x^2}(\log z)^3$ (6)

b) Change the order of integration and evaluate $I = \displaystyle\int_0^1\int_{x^2}^{2-x} \dfrac{x}{y}\, dy\ dx$ (6)

c) Show that $\displaystyle\int_0^\infty \dfrac{\tan^{-1} ax - \tan^{-1} bx}{x}\, dx = \dfrac{\pi}{2}\log\left(\dfrac{a}{b}\right)$ (8)

Q.3 a) Evaluate $I = \displaystyle\int_0^2\int_0^y\int_{x-y}^{x+y}(x+y+z)\, dx\, dy\, dz$ (6)

b) Find the mass of a plate in the form of a cardiode $r = a(1 - \cos\theta)$ (6)
if the density at any point of the plate varies as its distance from the
plate.

c) Solve $(2x+1)^2\dfrac{d^2y}{dx^2} - 2(2x+1)\dfrac{dy}{dx} - 12\,y = x^2$ (8)

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F.E Sem-II, (CBSGS)   20|11|2017

Q. 4 a) Show that the length of the curve $x = a e^{\theta} \sin \theta$ $y = a e^{\theta} \cos \theta$ from   (6)

$\theta = 0$ to $\theta = \pi/2$

b)   *Solve* $\dfrac{d^2 y}{dx^2} - y = \cos x \cosh x + a^x$ (6)

c)   Using fourth order Runge-Kutta method, solve numerically, the   (8)

differential equation $\dfrac{dy}{dx} = x^2 + y^2$ with the given condition x = 1,

y = 1.5 in the interval (1, 1.2) with h = 0.1

Q. 5 a)   Use method of variation of parameters to solve   (6)

$\dfrac{d^2 y}{dx^2} + y = 3 x - 8 \cot x.$

b)   Using Taylor's series method, obtain the solution of   (6)

$\dfrac{dy}{dx} = y - xy, \; y(0) = 2.$ Find the value of y for x = 0.1 correct to

four decimal places

c)   Evaluate $\int_{-1}^{1} \dfrac{dx}{6 + x^2}$ by using (i) Trapezoidal Rule, (ii) Simpson's   (8)

(1/3)rd Rule and (iii) Simpson's (3/8)th Rule. Compare the result with

exact solution.

Q. 6 a)   In a circuit of resistance R, self inductance L, the current i is given   (6)

by by $L\dfrac{di}{dt} + R i = E \cos pt$ where E and p are constants. Find the

current i at time 't'

b)   Find the area bounded by the parabola $y = 4 x - x^2$ and the line   (6)

y = x

c)   Find the volume of the paraboloid $x^2 + y^2 = 4 z$ cut off by the   (8)

plane z = 4.

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Q.P. Code :09911

[Time: 2 Hours]   [Marks:60]

Please check whether you have got the right question paper.

N.B:
1. Question no 1 is compulsory
2. Attempt any three questions from Q.2 to Q.6.
3. Use suitable data wherever required
4. Figures to the right indicate full marks.

Q.1 Attempt **any five** of the following.   15
- A Why the Newton's rings are circular and centre of interference pattern (reflected) is dark?
- B What is Rayleigh's criterion of resolution? Define resolving power of a grating?
- C Calculate the V number of an optical fibre having numerical aperture 0.25 and core diameter 20 μm, if its operating wavelength is 1.55 μm
- D What is pumping in LASER? Give the types of pumping.
- E Show that the divergence of the curl of a vector is zero.
- F Determine the magnetic field required to bend a beam consisting of electrons of speed 3×10^7 m/s in a circle of radius 5 cm.
- G What will be the fringe pattern if wedge shaped air film is illuminated with white light?

Q.2 A Obtain the condition for maxima and minima of the light reflected from a thin transparent film of uniform thickness. Why is the visibility of the fringe much higher in the reflected system than in the transmitted system?   08

B What is Numerical aperture? Explain the use of optical fibre in temperature sensor.   07
The core diameter of a multimode step index fibre is 50 μm. The numerical aperture is 0.25. Calculate the number of guided modes at an operating wavelength of 0.75 μm.

Q.3 A Explain the experimental method to determine the wavelength of spectral line using diffraction grating.   08
A diffraction grating has 5000 lines /cm and the total ruled width is 5cm. Calculate dispersion for a wavelength of 5000A° in the second order.

B Explain construction and working of Nd: YAG laser.   07

Q.4 A Explain Spherical co-ordinate system. State the transformation relation between Cartesian and Spherical coordinates.   05

B Explain construction and working of cathode ray tube.   05

C A wedge shaped air film having angle of 40 seconds is illuminated by monochromatic light. Fringes are observed vertically through a microscope. The distance between 10 consecutive dark fringes is 1.2cm. Find the wavelength of monochromatic light used.   05

Q.5 A With neat diagram explain construction and working of Atomic force microscope.   05

B Derive Maxwell's two general equations in integral and differential form.   05

C An electron is accelerated through a potential difference of 5 kV and enters a uniform magnetic field of 0.02 wb/m^2 acting normal to the direction of electron motion. Determine the radius of the path.   05

Q.6 A What are different techniques to synthesis nonomaterial? Explain one of them in detail.   05

B What is holography? Differentiate between holography and photography.   05

C Describe in detail the concept of anti reflecting film with a proper ray diagram.   05

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Q.P. Code :13125

[Time: Two Hours]   [Marks:60]

Please check whether you have got the right question paper.

N.B: 1.   Question.No.1 is compulsory.
         2.   Attempt **any three** questions out of remaining five.
         3.   Figures to the right indicate full marks.
         4.   Atomic weights:- C=12, S=32, N=14,H=1,O=16,Cl=35.5

1.   Answer **any five** from the following   15
    a)   Select the compound which possesses highest octane number and highest cetane number out of
         n-heptane, n- octane and isooctane.
    b)   Iron does not rust even if the zinc coating is broken in a galvanized iron pipe. Give reasons.
    c)   Calculate the higher and lower calorific values of coal sample containing 84% carbon, 1.5% sulphur,
         0.6 Nitrogen, 5.5% hydrogen and 8.4% oxygen.
    d)   What are the drawbacks of plain carbon steel.
    e)   Explain the principle 'Prevention of waste' in Green Chemistry.
    f)   Define and classify composite materials.
    g)   Mention three functions of thinner in paint.

2.
    a)   Define corrosion of metals. Explain the electrochemical theory of wet corrosion, giving its   6
         mechanism.
    b)   i) 1.56 g of a coal sample was kjeldahlised and NH_3 gas thus evolved was absorbed in 50ml of 0.1N   3
         H_2SO_4. After absorption the excess (residual) acid required 6.25 mL of 0.1N N_aOH for exact
         neutralization. Calculate the percentage of N in the coal sample.
         ii) What is super critical CO_2? Why is it considered a green solvent   2
    c)   Write a short note on Particle reinforced composites.   4

3.   a) What is cracking? Explain in detail –fixed bed catalytic cracking.   6
     b) i) Write a brief note on Heat resistant steel   3
         ii) A metal rod half immersed in water starts corroding at the bottom. Give reasons.   2
     c) Calculate the percentage atom economy for the following reaction with respect to allyl chloride.   4
         $CH_3-CH=CH_2 + Cl_2 \rightarrow Cl-CH_2-CH = CH_2 + HCl$
                     Allylchloride.

4.
    a)   Explain how the following factors affect the rate of corrosion   6
         i)   pH
         ii)   Ratio of anode to cathode areas
         iii)   Position of metal in galvanic series.

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b) i) Write a brief note on products obtained from natural materials **3**
ii) Define structural composites. **2**

c) Define Shape memory Alloys and mention its applications (at least four) **4**

5.
a) A sample of coal was found to contain the following constituents. C=81%; O=8% S=1%; H=5%, N=1% and Ash=4% **6**
Calculate the minimum weight and volume of an required for the complete combustion of 1kg of coal.

b) i) Discuss in brief sacrificial anode method of corrosion protection. **3**
ii) What is powder metallurgy? Mention any two advantages and two limitations of powder metallurgy **2**

c) Explain with suitable equations conventional and green synthesis of carbaryl. Also mention the principle of green chemistry involved. **4**

6.
a) Mention the composition, properties and uses of (Any two) **6**
   i) Duralumin
   ii) German silver
   iii) Gun metal

b) i) Mention the advantages of composite materials **3**
ii) Distinguish between anodic and cathodic coating **2**

c) What is biodiesel? Discuss the method to obtain biodiesel. What are the advantages of biodiesel? **4**

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FF. sem II (choice Based)
Engineering Drawing

Q. P. Code: 27855
20/12/2017
(3 Hours)
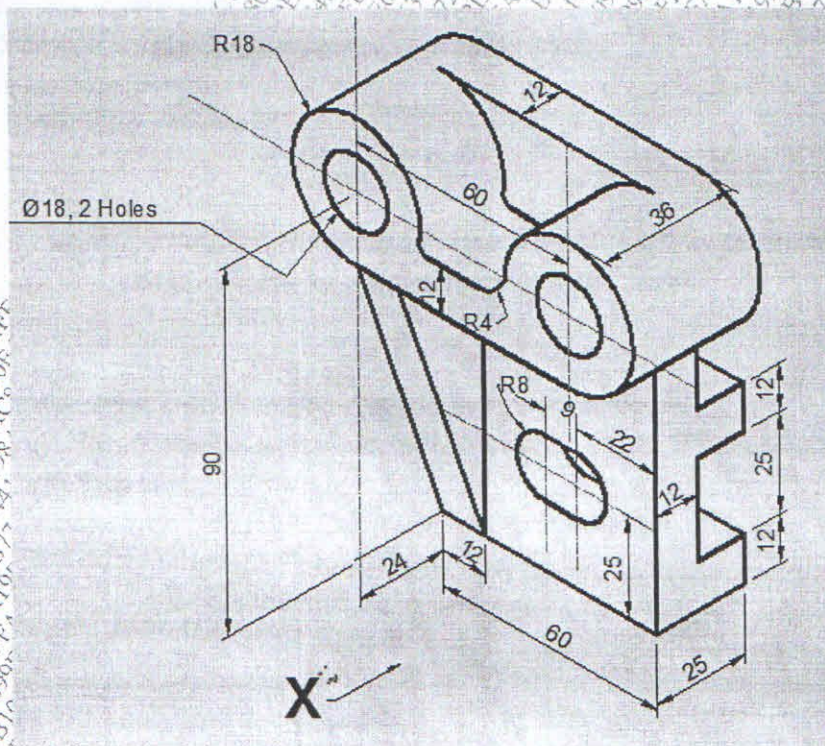[Total Marks: 60]

N. B. – 1. Attempt any four questions.
2. Use first angle method of projection, unless mentioned otherwise.
3. Write all answers on drawing sheets only & use both the sides of the sheets.
4. Use your own judgment for any unspecified dimension.
5. Retain construction lines.
6. All dimensions are in mm.

Q.1 (a) An inelastic string 100 mm long is wound around a disc of 40 mm diameter. **(06)** Trace the path of free end of a string and name the curve.

(b) For the object shown in figure draw the following views –
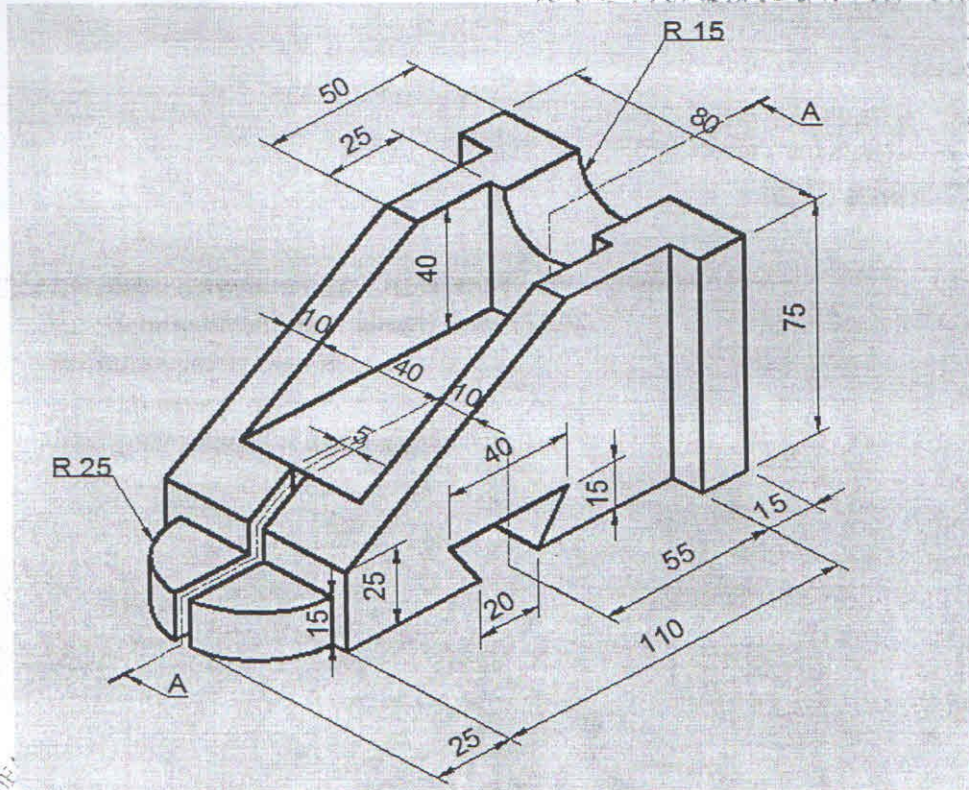(i) Front view in the direction of arrow X. **(05)**
(ii) Top view. **(04)**

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Q. 2   For the object shown in figure draw the following views –
(i) Sectional front view along section A-A.   (04)
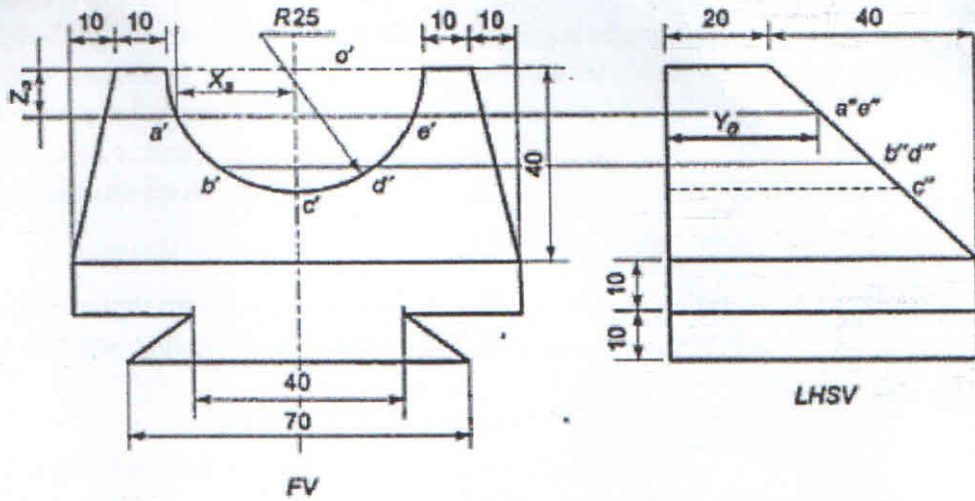(ii) Side view from left   (04)
(iii) Top view   (05)
(iv) Insert the major dimensions   (02)

Q. 3   A square pyramid side of base 40 mm and axis length 60 mm has one of its side   (15)
of base in the HP. The axis of the solid is inclined to the HP at an angle 30^0 and
top view of the axis is inclined at an angle 45^0 with the VP. Draw its projections
when the apex is away from the observer.

Q. 4 (a)   A right circular cylinder diameter of base 50 mm and axis height 70 mm has one   (06)
of the circumference point of base in the HP, such that its axis is inclined at 30^0
to the HP. Draw its projections.

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Q. 4   (b)   Figure shows two views of an object. Draw its isometric view.   (09)

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Q. 5   A cone of base 70 mm diameter and axis 90 mm long is resting on its base on   (15)
        HP. It is cut by a section plane perpendicular to the VP and parallel to and 15
        mm away from one of its end generators. Draw the sectional top view, front
        view & sectional side view. Also draw the true shape of the section. Also draw
        development of the lateral surface of the cone.

Q. 6   (a)   A straight line PQ has its end point P 10 mm above HP and 15 mm in front of   (09)
        the VP. The line is 50 mm long & its front and top views are inclined at an angle
        of 60⁰ & 45⁰ respectively. Draw the projections of the line PQ and find its
        inclinations with the HP & VP.

        (b)   Figure shows two views of an object. Draw its isometric view with 'O' as origin.   (06)

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