

**(REVISED COURSE)**Q.P. Code : **1049**

(2 Hours)

[ Total Marks : 60

- N.B. :** (1) Question No. 1 is **Compulsory**.  
 (2) Attempt any **three** from remaining six questions  
 (3) All **questions** carry **equal** marks.  
 (4) Figures to the right indicate full marks.  
 (5) Atomic weights : H=1, C=12, S=32, N=14, O=16, Cl=35.5, Ba=137.3, Na=23, Mg=24.

1. Answer any **five** from the following :-

15

- (a) What are propellants ? State important characteristics of good propellant.  
 (b) Compare Galvanizing and Tinning.  
 (c) Give composition, properties and uses of Wood's Metal.  
 (d) Write a note on 'Green Reagent'.  
 (e) Define terms :-  
 (i) Composite material (ii) Matrix phase (iii) Dispersed phase.  
 (f) List three main constituents of Varnish & give functions of each.  
 (g) A coal sample was subjected to ultimate analysis :

1.6 gm of coal on combustion in a Bomb calorimeter gave 0.47 gm of BaSO<sub>4</sub>  
 Calculate % of sulphur in the coal sample.

2. (a) What is dry corrosion ? Explain with example how nature of oxidised product affect the rate of corrosion. 6  
 (b) What is cracking ? Explain fixed bed catalytic cracking with diagram. 5  
 (c) Calculate percentage atom economy for the following reaction w.r. to methyl iso-cyanate 4  

$$\text{CH}_3\text{NH}_2 + \text{COCl}_2 \rightarrow \text{CH}_3\text{-N=C=O} + 2\text{HCl}$$
 methyl iso cyanate.  
 3. (a) A gaseous fuel has the following composition by volume. 6  
 $\text{CH}_4 = 35\%$  ,  $\text{C}_2\text{H}_6 = 5\%$  ,  $\text{CO} = 15\%$  ,  $\text{H}_2 = 40\%$  ,  $\text{N}_2 = 1\%$  water vapour = 4%  
 Calculate volume & weight of air required for complete combustion of 1m<sup>3</sup> of fuel [mol.wt of air = 28.94]  
 (b) Explain conventional & green synthesis of adipic acid. Mention the green chemistry principle involved. 5  
 (c) How the rate of corrosion influenced by following factors. 4  
 (i) PH of medium (ii) Over voltage.  
 4. (a) What is powder Metallurgy ? How are metal powders prepared using. 6  
 (i) Atomization (ii) Chemical reduction  
 (b) What is cathodic protection ? Explain Impressed current method of corrosion control. 5

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- (c) Write a note on 'Sandwich panel' type layered composites. 4
5. (a) What is Bio-diesel ? Explain the trans esterification method for its synthesis. 6  
Mention advantages of biodiesel as fuel.
- (b) What are alloys ? Explain any four purposes of making alloys with suitable example. 5
- (c) Discuss the physical factors influencing adhesive action. 4
6. (a) Write a note on differential aeration corrosion. 5
- (b) 2.5 gm of air dried coal sample was taken in a silica crucible , after heating it in an electric oven at  $110^{\circ}\text{C}$  for 1hr the residue was weighed 2.41 gm. The residue was heated in Silica crucible covered with vented lid at a temperature  $925 \pm 25^{\circ}\text{C}$  for exactly 7 minutes. After cooling the weight of residue was found to contain 1.98 gm. The residue was then ignited to a constant weight of 0.246 gm. Report the results of above analysis. 5
- (c) Explain the effects of following elements on alloying :- 5
- (i) Nickel
  - (ii) Chromium
  - (iii) Cobalt
  - (iv) Molybdenum
  - (v) Carbon.
-

Duration: 03 Hours

Max. Marks: 60

**N.B.**

1. Question No.1 is compulsory. Solve any three out of remaining five questions.
2. Use your own judgment for any unspecified dimension.
3. Use first angle method only.
4. Retain all construction lines.
5. Figures to the right indicate full marks.

Q.1.a)

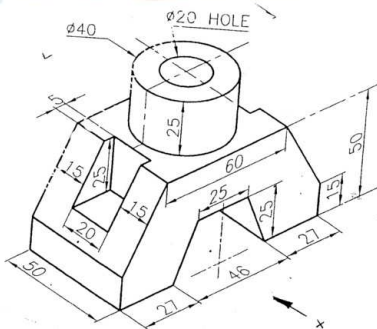
A circle of 60mm diameter rolls on a straight line without slipping. Draw the locus of a point 'P' for complete revolution of the circle. The point 'P' is 38mm above the straight line and towards the right of vertical center line of the circle.

06

Q.1. b)

Figure 1 shows pictorial view of an object. Draw

- |                          |    |
|--------------------------|----|
| i) Front view            | 04 |
| ii) Top view             | 04 |
| iii) Dimension the views | 01 |



All dimensions are in mm

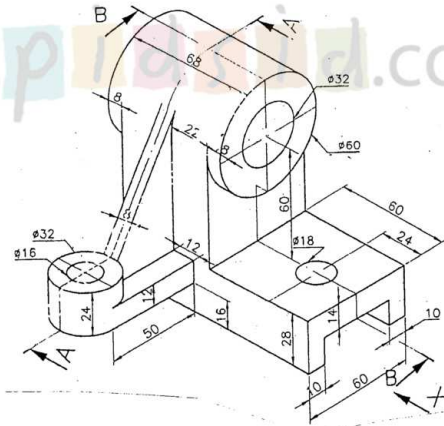
Figure no. 1

Q.2.

A pentagonal prism of 28mm. edge of base and 60 mm length of axis has a 28mm. edge on the H.P. The axis is inclined at  $35^\circ$  to H.P. and  $45^\circ$  to V.P. Draw the projections. 15

Q.3. Figure 2 shows pictorial view of an object. Draw

- |      |  |   |
|------|--|---|
| i)   | Sectional Front View along A-A.          | 5 |
| ii)  | Sectional Left hand side view along B-B. | 5 |
| iii) | Top View                                 | 4 |
|      | Dimension the views (any four)           | 1 |



All dimensions are in mm  
Figure 2

Q.4. a)

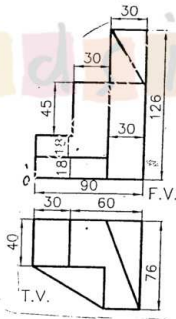
The distance between the end projectors of a line AB is 60mm. The end A is 25mm above H.P. and 45mm in front of V.P., while the other end B is 60mm above H.P. and 15mm in front of V.P. Draw projections and find the true length and also inclination of the line with H.P. and V.P.

09

Q.4 b).

Figure 3 shows two views of an object. Draw isometric view of the object.

06



All dimensions are in mm.

Figure 3

Q.No.5

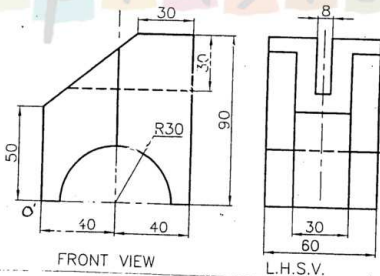
A square pyramid of base side 25mm and altitude 50mm rests on its base on the HP with two sides of the base parallel to VP. It is cut by a plane bisecting the axis and inclined at  $30^\circ$  to the base. Draw front view, sectional top view and true shape of the section. Also draw the development of the lower part of the pyramid. 15

Q.No.6 a)

A cylinder with 50mm diameter of its base and axis measuring 70mm has its axis inclined to  $30^\circ$  to VP. Draw the projections of the cylinder when the solid is resting on one of the points of the circumference of the base on VP. 6

Q.No.6 b).

Draw isometric projection using natural scale. Refer Figure No.4. 9



All dimensions are in mm

Figure no.4

**(REVISED COURSE)**QP Code : **1037**

(3 Hours)

[Total Marks : 80]

- N.B.** (1) Question no. 1 is compulsory.  
 (2) Solve any three questions from the remaining six questions  
 (3) Each questions carry equal marks.

1. (a) Evaluate  $\int_0^{\infty} \frac{x^4}{4^x} dx$  3  
 (b) Find P.I. of  $(D^2 - 4D + 4)y = e^{2x} + \cos 2x$  3  
 (c) Show that  $\nabla = 1 - E^{-1}$  3  
 (d) Evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{dy dx}{1+x^2+y^2}$  3  
 (e) Solve  $(1 + e^{x/y})dx + e^{x/y} \left(1 - \frac{x}{y}\right) dy = 0$  4  
 (f) Evaluate  $\int_0^{\infty} \int_0^{\infty} e^{-(x^2+y^2)} dx dy$  by changing to polar co-ordinates 4
2. (a) Solve  $y^4 dx = (x^{-3/4} - y^3 x) dy$  6  
 (b) Change the order of integration and evaluate  $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{y}{(1+xy)^2(1+y^2)} dy dx$  6  
 (c) (1) P.T.  $\int_0^{\infty} \frac{x^{m-1}}{(a+bx)^{m+n}} dx = \frac{1}{a^n b^m} \beta(m, n)$  4  
 (2) P.T.  $\int_0^{\infty} \frac{\log(i+ax^2)}{x^2} dx = \pi\sqrt{a}$ , where  $a > 0$  4
3. (a) Evaluate  $\int_0^{\log 2} \int_0^{x-\log y} e^{x+y+z} dz dy dx$  6  
 (b) Find the area bounded between the parabola  $x^2 = 4ay$  and  $x^2 = -4a(y-2a)$  6

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- (c) Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} + y = \sec x \tan x$$

4. (a) Find the length of the cardioid
- $r = a(1 - \cos \theta)$
- lying outside the circle
- $r = a \cos \theta$

(b) Solve  $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 3y = 2xe^{3x} + 3e^x \cos 2x$

- (c) Using R.K. Method of fourth order, solve.

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2} \text{ given } y(0) = 1 \text{ at } x = 0.2, 0.4$$

5. (a) Solve
- $x \sin x dy + (xycos x - y \sin x - 2)dx = 0$

- (b) Solve
- $\frac{dy}{dx} = 2 + \sqrt{xy}$
- with
- $x_0 = 1.2, y_0 = 1.6403$
- by modified Euler's method, for
- $x = 1.4$
- correct to 4-decimal places, (taking
- $h = 0.2$
- )

- (c) Evaluate
- $\int_0^6 xf(x)dx$
- by

(a) Trapezoidal rule

(b) Simpson's 1/3<sup>rd</sup> rule

using the following table

x	0	1	2	3	4	5	6
f(x)	0.146	0.161	0.176	0.190	0.204	0.217	0.230

6. (a) 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

$$R \frac{dQ}{dt} + \frac{Q}{c} = V, \text{ If } Q = 0 \text{ at } t = 0, \text{ show that } i = \frac{V}{R} e^{-t/RC} \therefore i = \frac{dQ}{dt}$$

- (b) Evaluate
- $\iint_A x^2 dx dy$
- where A is the region in the first quadrant bounded by the hyperbola
- $xy = 16$
- and the lines
- $y = x, y = 0$
- and
- $x = 8$
- .

- (c) Find the volume of the tetrahedron bounded by the planes,
- $x = 0, y = 0, z = 0$
- and
- $x + y + z = a$



Q.P. Code : 1044

**(REVISED COURSE)**

(2 Hours)

[ Total Marks : 60

- 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.**

1. Attempt any five of the following :- 15
- Comment on colours in a soap film in sunlight.
  - What is Rayleigh's criterion of resolution? Define resolving power of a grating.
  - Calculate V number for an optical fiber having numerical aperture 0.25 and core diameter  $20 \mu\text{m}$  if it is operated at  $1.55 \mu\text{m}$ .
  - Compare light from ordinary source with laser light.
  - How phase difference between two signals is measured using CRO?
  - What are the properties of matter waves?
  - A superconductor has a critical temperature  $3.7^\circ\text{K}$  at zero magnetic field. At  $0^\circ\text{K}$  the critical magnetic field is  $0.0306 \text{ Tesla}$ . What is the critical magnetic field at temperature  $2.0^\circ\text{K}$ ?
2. (a) Show that the diameter of Newton's  $n^{\text{th}}$  dark ring is proportional to square root of ring number. In Newton's rings experiment the diameter of  $5^{\text{th}}$  dark ring was  $0.336 \text{ cm}$  and that of  $15^{\text{th}}$  dark ring was  $0.590 \text{ cm}$ . Calculate the radius of curvature of plano-convex lens if wavelength of light used is  $5890 \text{ \AA}$ . 8
- (b) Derive an expression for numerical aperture of step index optical fiber. What are the advantages of using an optical fiber? 7
3. (a) Explain construction and working of He-Ne laser. What are its merits? 8
- (b) Derive the condition for a thin transparent film of constant thickness to appear bright and dark when viewed in reflected light. 7
4. (a) Calculate the maximum order of diffraction maxima seen from a plane diffraction grating having  $5500 \text{ lines per cm}$  if light of wavelength  $5896 \text{ \AA}$  falls normally on it. 5
- (b) Derive Schrodinger's time-independent wave equation. 5
- (c) Define the term superconductivity. Show that in the superconducting state the material is perfectly diamagnetic. 5

5. (a) A slit of width 0.3 mm is illuminated by a light of wavelength 5890 Å. A lens whose focal length is 40 cm forms a Fraunhofer diffraction pattern. Calculate the distance between first dark and the next bright fringe from the axis. 5
- (b) An electron is accelerated through 1000 volts and is reflected from a crystal. The first order reflection occurs when glancing angle is  $70^\circ$ . Calculate the interplanar spacing of a crystal. 5
- (c) Explain construction and working of Atomic Force Microscope. 5
6. (a) State Heisenber's uncertainty principle. Show that electron cannot pre-exist in free state in a nucleus. 5
- (b) Draw a labelled diagram and explain construction and working of CRT. 5
- (c) Explain top down and bottom up approaches to prepare nanomaterials. 5
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