

**Common All Branches
Bachelor Of Engineering
Question Papers May - June 2018
Sem – I & II**

R-2016

Q. P. Code : 38779

Date: 14/05/18

(3 Hours)

(Total Marks: 80)

Please check whether you have the right question paper.

- N.B.: 1) Questions No. 1 is compulsory.
2) Answer any three from remaining five questions.

1. a) If $\tan \frac{x}{2} = \tan h \frac{u}{2}$, show that $u = \log \left[\tan \left(\frac{\pi}{4} + \frac{x}{2} \right) \right]$. [3]

b) Prove that the following matrix is orthogonal & hence find A^{-1} . [3]

$$A = \frac{1}{3} \begin{bmatrix} -2 & 1 & 2 \\ 2 & 2 & 1 \\ 1 & -2 & 2 \end{bmatrix}$$

c) State Euler's theorem on Homogeneous function of two variables & if [3]

$$u = \frac{x+y}{x^2+y^2} \text{ then evaluate } x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}.$$

d) If $u = r^2 \cos 2\theta$, $v = r^2 \sin 2\theta$. Find $\frac{\partial(u,v)}{\partial(r,\theta)}$. [3]

e) Find the n^{th} derivative of $\cos 5x \cdot \cos 3x \cdot \cos x$. [4]

f) Evaluate: $\lim_{x \rightarrow 0} \left(\frac{2x+1}{x+1} \right)^{\frac{1}{x}}$. [4]

2. a) Solve $x^4 - x^3 + x^2 - x + 1 = 0$. [6]

b) If $y = e^{\tan^{-1}x}$. Prove that [6]

$$(1+x^2)y_{n+2} + [2(n+1)x-1]y_{n+1} + n(n+1)y_n = 0.$$

c) Examine the function $f(x, y) = xy(3-x-y)$ for extremes values & [8]
also find maximum and minimum values of $f(x, y)$.

TURN OVER

3. a) Investigate for what values of λ & μ the equations $x+y+z=6$; [6]

$$x+2y+3z=10; x+2y+\lambda z=\mu \text{ have}$$

- i) no solution,
- ii) a unique solution,
- iii) infinite no. of solutions.

- b) If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, show that $x^2 \frac{\partial u}{\partial y} + y^2 \frac{\partial u}{\partial x} + z^2 \frac{\partial u}{\partial z} = 0$. [6]

- c) Prove that $\log\left(\frac{a+ib}{a-ib}\right) = 2i \tan^{-1}\left(\frac{b}{a}\right)$ & [8]

$$\cos\left[i \log\left(\frac{a+ib}{a-ib}\right)\right] = \frac{a^2 - b^2}{a^2 + b^2}$$

4. a) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Prove that [6]

$$x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} = \frac{-\sin u \cos 2u}{4 \cos^3 u}$$

- b) Using encoding matrix $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$; encode & decode the message [6]

'ALL IS WELL'.

- c) Solve the following equations by Gauss Seidal method : [8]

$$10x_1 + x_2 + x_3 = 12$$

$$2x_1 + 10x_2 + x_3 = 13$$

$$2x_1 + 2x_2 + 10x_3 = 14$$

5. a) If $u = e^{xyz} f\left(\frac{xy}{z}\right)$ where, $f\left(\frac{xy}{z}\right)$ is an arbitrary function of $\frac{xy}{z}$, [6]

$$\text{Prove that } x \frac{\partial u}{\partial x} + z \frac{\partial u}{\partial z} = y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 2xyz \cdot u.$$

TURN OVER

b) Prove that $\sin^5 \theta = \frac{1}{16} (\sin 5\theta - 5\sin 3\theta + 10\sin \theta)$. [6]

c) i) Prove that $\log(\sec x) = \frac{1}{2}x^2 + \frac{1}{12}x^4 + \dots$ [4]

ii) Expand $(2x^3 + 7x^2 + x - 1)$ in powers of $(x - 2)$. [4]

6. a) Prove that $\sin^{-1}(\operatorname{cosec} \theta) = \frac{\pi}{2} + i \log \left(\cot \frac{\theta}{2} \right)$. [6]

b) Find non-singular matrices P & Q such that $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ is [6]

reduced to normal form. Also find its rank.

c) Obtain the root of $x^3 - x - 1 = 0$ by Regula Falsi Method (Take three iterations). [8]

TURN OVER

Time: 2 hours

Marks: 60

- N. B. 1) Question no 1 is compulsory.
 2) Attempt any **three** questions from Q.2 to Q.6
 3) Assume suitable data wherever required.
 4) Figures on the **right** indicates marks.

05/06/18

- | | | |
|---|--|----|
| 1 | Attempt any five | 15 |
| a | Why X-rays are used to study the crystal structure? | |
| b | Calculate the frequency and wavelength of photon whose energy is 75eV. | |
| c | Draw the energy band diagram of p-n junction diode in forward and reverse bias condition. | |
| d | "Superconductor is a perfect diamagnetic", Explain. | |
| e | What is reverberation time? How is it important? Write the factor affecting reverberation time. | |
| f | A quartz crystal of thickness 1.5mm vibrating with resonance. Calculate it's fundamental frequency if the Young's modulus of quartz crystal is $7.9 \times 10^{10} \text{N/m}^2$. and density is 2650kg/m^3 . | |
| g | Mobility's of electron and hole in a sample of Ge at room temperature are $0.36 \text{m}^2/\text{V-sec}$ and $0.17 \text{m}^2/\text{V-sec}$. respectively. If electron and hole densities are equal and it is $2.5 \times 10^{13}/\text{cm}^3$, calculate its conductivity. | |
| 2 | a Arrive at Heisenberg's uncertainty principle with single slit electron diffraction. | 4 |
| | An electron has a speed of 300m/sec. with uncertainty of 0.01%. Find the accuracy in its position. | 4 |
| | b Write the Fermi Dirac distribution function and terms in it. | 7 |
| | What is the probability of an electron being thermally excited to the conduction band in Si at 30°C . The band gap energy is 1.12eV. | |
| 3 | a With neat diagram of unit cell, explain the structure of NaCl crystal and calculate the no of ions per unit cell, coordination no. and lattice constant. Calculate the packing factor of NaCl crystal assuming the radius of Na^+ is 0.98\AA and radius of Cl^- is 1.81\AA . | 8 |
| | b State the Hall effect. Derive the expression for Hall voltage and Hall coefficient with neat diagram. | 7 |
| 4 | a What is working principle of SQUID? Explain how it is used to detect the magnetic field? | 5 |
| | b A hall of dimensions $25 \times 18 \times 12 \text{m}^3$ has an average absorption coefficient 0.2. Find the reverberation time. If a curtain cloth of area 150m^2 is suspended at the Centre of hall with coefficient of absorption 0.75, What will be the reverberation time? | 5 |
| | c State the piezoelectric effect. With neat circuit diagram explain the principle and working of piezoelectric oscillator. | 5 |

- 5
 - a With energy band diagram, explain the variation of Fermi energy level with impurity concentration in extrinsic semiconductor. 5
 - b Explain with example how to determine crystal structure by Bragg's X-ray spectrometer. 5
 - c Obtain one dimensional time independent Schrodinger equation. 5

- 6
 - a Define ligancy and critical radius ratio. Calculate critical radius ratio for ligancy 8. 5
 - b What is the significance of wave function? Derive the expression for energy eigen values for free particle in one dimensional potential well. 5
 - c What is photovoltaic effect? Explain the principle and working of Solar cell. 5

$$\begin{array}{r} 40 \\ + 40 \end{array}$$

$$+ 40$$

$$+ 26$$

$$+ 10$$

$$156$$

Please check whether you have got the right question paper.

- N.B:
1. Question.No.1 is compulsory.
 2. Attempt any three questions from the remaining five.
 3. All questions carry equal marks.
 4. Figures to the right indicate full marks.
 5. Atomic weights : H = 1, Mg = 24, Ca = 40, C = 12, O = 16, N = 14, S = 32, Cl = 35.5, Na = 23

Q.1. Attempt any five from the following :-

- a) Discuss the drawbacks of natural Rubber.
- b) Explain disinfection of water by addition of bleaching Powder.
- c) What are the limitations of Phase Rule?
- d) Discuss fullerenes. Give its applications.
- e) Write a note on Greases.
- f) A 10ml of sample of water was refluxed with 20ml potassium dichromate solution and after refluxing, the excess unreacted dichromate required 26.2ml of 0.1M FAS solution. A blank 10ml of distilled water on refluxing with 20ml of dichromate solution required 36ml of 0.1M FAS solution. Calculate the COD of waste water.
- g) Discuss the role of Polymers in Medicine and surgery.

15

- Q.2. a) Calculate the amount of lime (85% pure) and Soda (95% pure) required to soften one million liter of water which contains $\text{CaCO}_3 = 12.5\text{ppm}$, $\text{Mg CO}_3 = 8.4\text{ppm}$, $\text{CaCl}_2 = 22.2\text{ppm}$, $\text{MgCl}_2 = 9.5\text{ppm}$, $\text{CO}_2 = 33\text{ppm}$, $\text{HCl} = 7.3\text{ppm}$, Organic matter = 16.8ppm.
- b) i) Give the preparation, properties and uses of Kevlar.
- ii) Define Cloud Point and Pour Point of a lubricant.
- c) Write a note on Decay of Concrete.

6

3

2

4

- Q.3. a) Define Moulding. List the different techniques of moulding. Explain injection moulding with the help of neat diagram.
- b) i) Explain the term 'Phase' with appropriate examples.
- ii) Discuss the role of gypsum during the manufacturing of Portland cement.
- c) Calculate the total hardness in ppm, in given water sample.
- : 50ml of standard hard water, containing 1mg pure CaCO_3 per ml consumed 20ml EDTA solution.
- : 50ml of water sample consumed 30ml EDTA solution using EBT indicator.

6

3

2

4

- Q.4. a)** Explain the zeolite method for softening of water giving suitable diagram and reactions. What are the limitations of this method. 6
- b) i)** 6gms of oil was saponified with 50ml of 0.5N alcoholic KOH solution. After refluxing for 2 hours the mixture was titrated with 25ml 0.5 N HCl. Find the saponification value of Oil. 3
- ii)** Distinguish between the wet and Dry process for manufacturing of Portland cement. 2
- c)** Discuss the following additives in compounding of plastics. 4
- : Fillers : Plasticizers
- Q.5. a)** Write notes on : (any two) 6
- : Glass transition temperature : Buna – S rubber : Vulcanisation
- b) i)** Distinguish between : BOD and COD. 3
- ii)** Define Oilness. What is its significance. 2
- c)** Discuss the application of Phase Rule to the one component system based on ; 4
- Diagram , triple point
- Q.6. a)** Define lubricants and lubrication. Mention the various mechanisms involved in lubrication of machines. Discuss boundary lubrication. 6
- b) i)** What is reduced or condensed Phase Rule. 3
- ii)** Discuss Reverse Osmosis. 2
- c)** What are carbon nanotubes. What are its types. Discuss the laser method for its production. 4

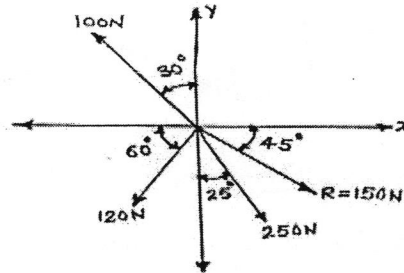
N.B. (1) Question No.1 is compulsory.

(2) Attempt any 3 questions from remaining five questions

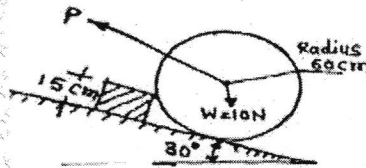
(3) Assume suitable data if necessary, and mention the same clearly.

(4) Take $g=9.81\text{m/s}^2$, unless otherwise specified.

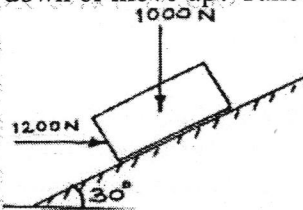
Q1 a) Find fourth force (F_4) completely so as to give the resultant of the system of force as shown in figure.



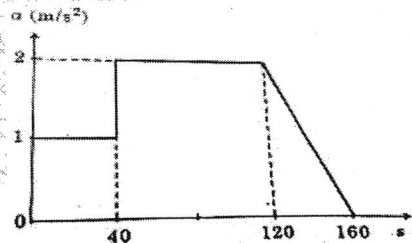
b) Determine the magnitude and direction of the smallest force 'P' required to start the wheel W=10N over the block



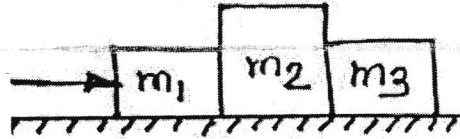
c) If a horizontal force of 1200N is applied to block of 1000N, then block will be held in equilibrium or slide down or move up? Take $\mu=0.3$



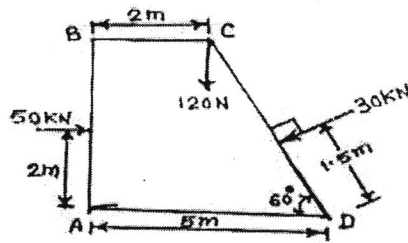
d) Starting from rest at $S=0$, a car travels in a straight line with an acceleration as shown by the a-s graph. Determine the car's speed when $S=20\text{m}$, $S=100\text{m}$ and $S=150\text{m}$



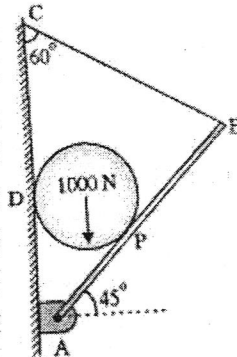
- e) Three m_1 , m_2 and m_3 of masses 1.5kg, 2kg and 1kg respectively are placed on a rough surface with coeff. of friction 0.20 as shown. If a force 'F' is applied to accelerates the blocks at 3m/s^2 . What will be the force that 1.5kg block exerts on 2kg block. 4



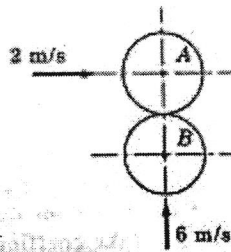
- Q2 a) A dam is subjected to three forces as shown in fig. Determine the single equivalent force and locate its point of intersection with base AD. 6



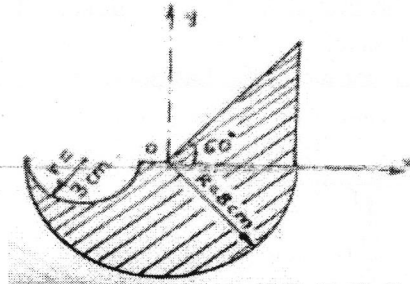
- b) A cylinder weighing 1000N and 1.5m diameter is supported by a beam AB of length 6m and weight 400N as shown. Neglecting friction at the surface of contact of the cylinder. Determine i) Wall reaction at 'D' ii) Hinged reaction at support 'A' iii) Tension in the cable BC. 8



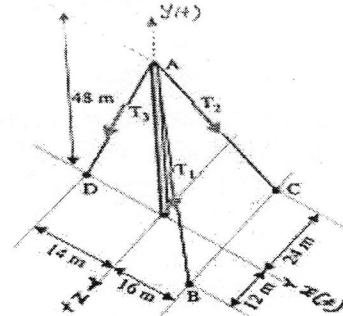
- c) Two balls of 0.12kg collide when they are moving with velocities 2m/sec and 6 m/sec perpendicular to each other as shown in fig. If coefficient of restitution between 'A' and 'B' is 0.8 determine the velocity of 'A' and 'B' after impact. 6



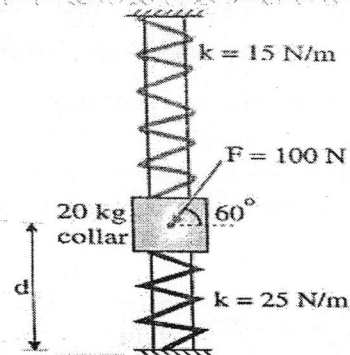
- Q3 a) Find the centroid of the shaded portion of the given area shown in figure. 8



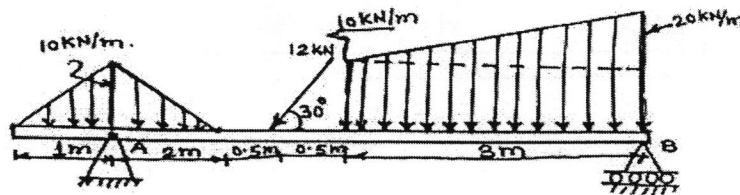
- b) Knowing that the tension in AC is $T_2 = 20 \text{ kN}$. Determine required values T_1 (tension in AB) and T_3 (tension in AD) so that the resultant of the three forces at 'A' is vertical. Also calculate this resultant. 6



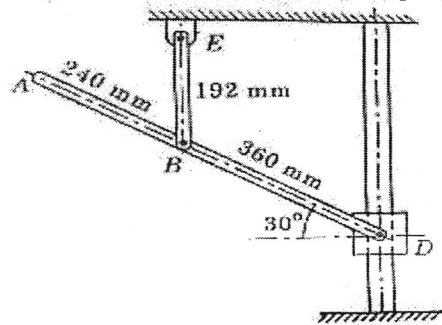
- c) Fig. shows a collar of mass 20 kg which is supported on the smooth rod. The attached springs are both compressed 0.4 m when $d = 0.5 \text{ m}$. Determine the speed of the collar after the applied force $F = 100 \text{ N}$ causes it to be displaced so that $d = 0.3 \text{ m}$. Knowing that collar is at rest when $d = 0.5 \text{ m}$. 6



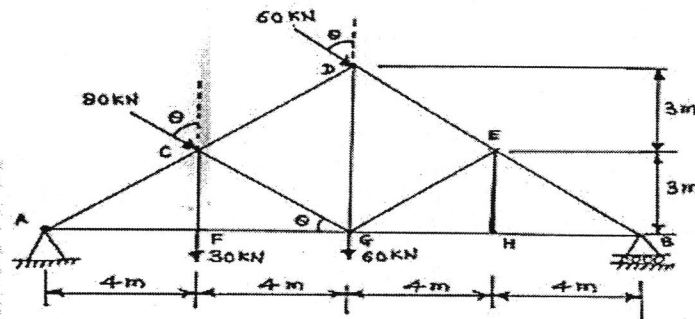
- Q4 a) Find the support reactions at point 'A' and 'B' of the given beam 8



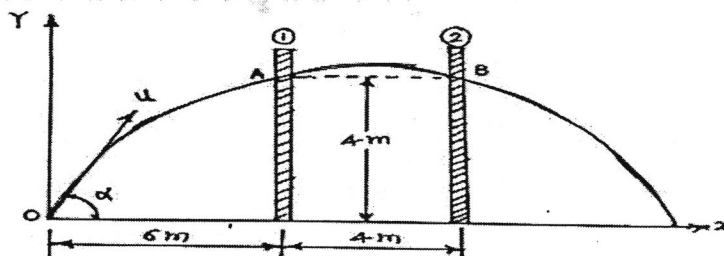
- b) The motion of the particle is defined by the relation $a = (0.8t) \text{ m/sec}^2$ where 't' is measured in sec. It is found that at $X=5\text{m}$, $V=12\text{m/sec}$ when $t=2\text{sec}$. Find the position and velocity at $t=6\text{sec}$. 6
- c) Rod EB in the mechanism shown in fig. has angular velocity of 4 rad/sec at the instant shown in counter clockwise direction. Calculate i) angular velocity of rod AD ii) velocity of collar 'D' iii) Velocity of point 'A' 6



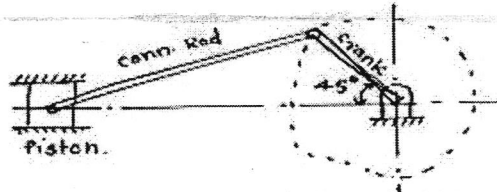
- Q5 a) A simply supported pin jointed truss is loaded and supported as shown in fig. i) Identify the members carrying zero forces ii) Find support reactions iii) Find forces in members CD, CG, FG and CF using method of section. 8



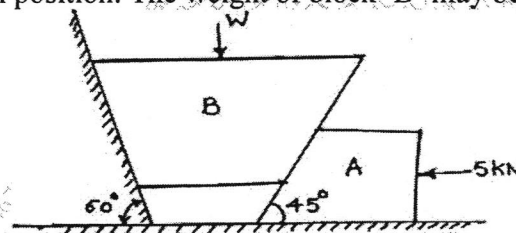
- b) A jet of water discharging from a nozzle hits a vertical screen placed at a distance of 6m from the nozzle at a height of 4m. When the screen is shifted by 4m away from the nozzle from its initial position the jet hits the screen again at the same point. Find the angle of projection and velocity of projection of the jet at the nozzle. 6



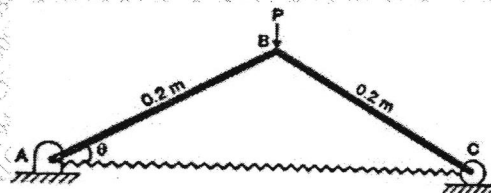
- c) In a crank and connecting rod mechanism the length of crank and connecting rod are 300mm and 1200mm respectively. The crank is rotating at 180rpm. Find the velocity of piston, when the crank is at an angle of 45° with the horizontal. 6



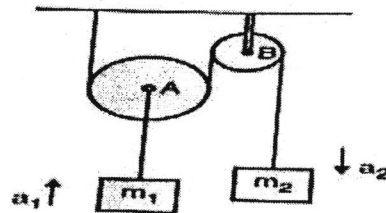
- Q6 a) Force $F = 80i + 50j - 60k$ passes through a point $A(6, 2, 6)$. Compute its moment about a point $B(8, 1, 4)$. 4
- b) A horizontal force of 5kN is acting on the wedge as shown in fig. The coefficient of friction at all rubbing surfaces is 0.25. Find the load 'W' which can be held in position. The weight of block 'B' may be neglected. 8



- c) The stiffness of the spring is 600N/m. Find the force 'P' required to maintain equilibrium such that $\theta = 30^\circ$. The spring is unstretched when $\theta = 60^\circ$. Neglect weight of the rods. Use method of virtual work. 4



- d) Two masses are interconnected with the pulley system. Neglecting frictional effect of pulleys and cord, determine the acceleration of mass m_2 . Take $m_1 = 50\text{kg}$ and $m_2 = 40\text{kg}$. 4



N.B. : (1) Question No.1 is compulsory.

(2) Solve any three from remaining questions.

(3) Assume suitable data if necessary.

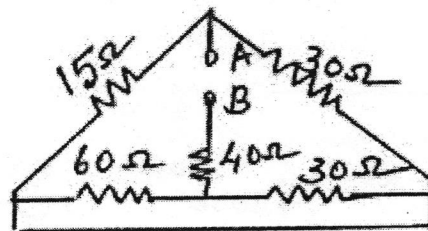
(4) Figures to the right indicate full marks.

24/05/18

1. Answer any Five :

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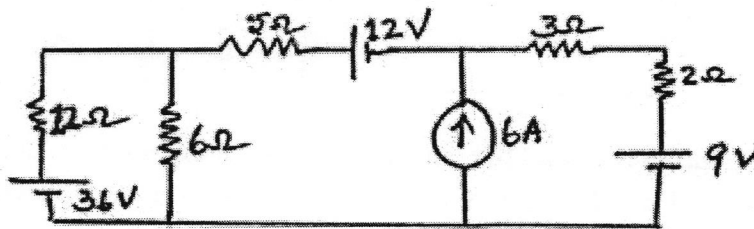
- What is the difference between ideal source and actual source? Illustrate the concept using the V-I characteristics of voltage and current source.
- In a balanced three phase circuit the power factor is 0.866. What will be the ratio of two wattmeter reading if the power is measured using two wattmeters.
- Calculate R_{AB} .



- Derive the equation for resonance frequency for a parallel circuit in which a capacitor is connected in parallel with a coil having resistance R and inductive reactance X_L . What is the resonance frequency if inductor is ideal?
- What are the classifications of DC motor? Specify one application for each one.
- Derive emf equation of a single phase transformer.

2. (a) Using mesh analysis find current through 5Ω .

08

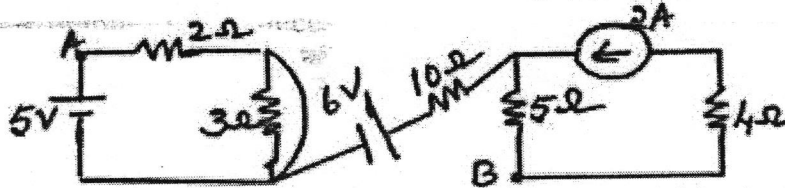


- An emf of 250 V is applied to an impedance $Z_1 = (12.5 + j20)\Omega$. An impedance Z_2 is added in series with Z_1 , the current become half of the original and lead the supply voltage by 20° . Determine Z_2 .

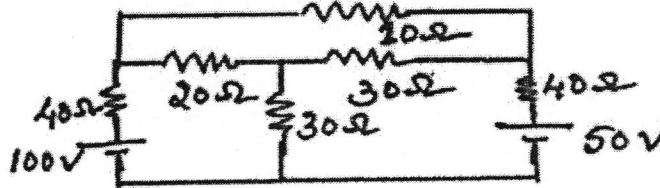
08

TURN OVER

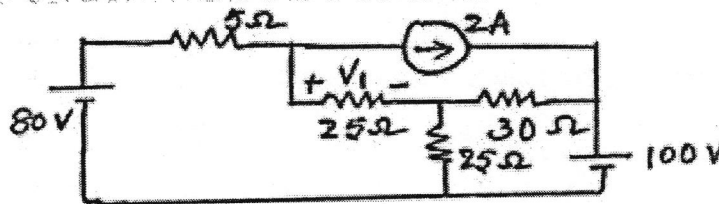
- (c) Determine the potential difference V_{AB} for the given network. 04



3. (a) When a voltage of 100 V, 50 Hz is applied to an impedance A current taken is 8 A lagging and power is 120 W. When it is connected to an impedance B the current is 10 A leading and power is 500 W. What current and power will be taken if it is applied to the two impedances connected in series. 08
- (b) Find current through 10 Ω using Thevenin's theorem. 08



- (c) With the help of equivalent circuit of a single phase transformer show how total copper loss can be represented in primary of a transformer. 04
4. (a) Find V_1 using super position theorem. 08



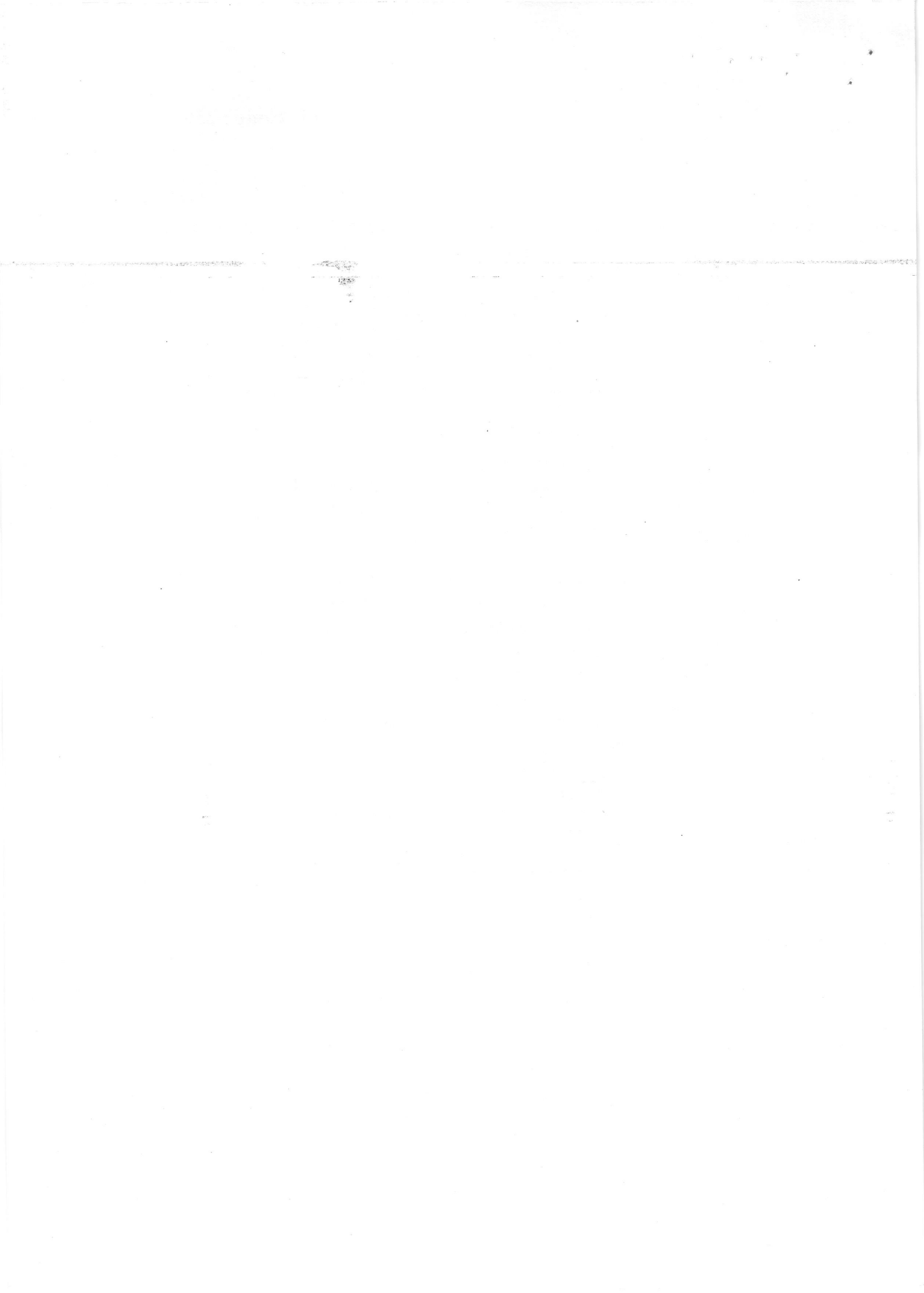
- (b) In an R-L-C parallel circuit the current through the resistor, inductor (pure) and capacitor are 20 A, 15 A and 40 A respectively. What is the current taken from the supply? Draw phasor diagram. 04
- (c) Two sinusoidal sources of emf have rms value E_1 and E_2 . When connected in series, with a phase displacement α the resultant voltage read on an electro-dynamometer voltmeter is 41.1 V and with one source reversed 17.52 V. When the phase displacement made zero a reading of 42.5 V is observed. Calculate E_1 , E_2 and α . 08

TURN OVER

5. (a) Prove that the power in a balanced three phase delta connected circuit can be deduced from the readings of two wattmeter. Draw relevant connections and vector diagrams. Draw a table to show the effect of power factor on wattmeter. 08
- (b) A 5 kVA 200/400, 50 Hz single phase transformer gave the following test results. 08

OC test on LV side	200 V	0.7 A	60 W
SC test on HV side	22 V	0.16 A	120 W

- (i) Draw the equivalent circuit of the transformer and insert all parameter values.
- (ii) Efficiency at 0.9 pf lead and rated load.
- (iii) Current at which efficiency is maximum.
- (c) Prove that if the phase impedances are same, power drawn by a balanced delta connected load is three times the power drawn by the balanced star connected load. 04
6. (a) Three identical coils each having a reactance of 20Ω and resistance of 10Ω are connected in star across a 440 V three phase line. Calculate for each method : 08
- (i) Line current and phase current.
- (ii) Active, reactive and apparent power.
- (iii) Reading of each wattmeter connected to measure the power.
- (b) A series resonant circuit has an impedance of 500Ω at resonant frequency. The cut of frequency observed are 10kHz and 100 Hz. Determine : 06
- (i) Resonant frequency.
- (ii) Value of R, L and C.
- (iii) Q factor at resonance.
- (c) Draw and illustrate transformer phasor diagram for lagging power factor. 06



FE. (Sem I) / Choice Base / Environmental Studies

Q. P. Code: 50594

N.B: QUESTION NO 1 IS COMPULSARY AND ATTEMPT ANY THREE QUESTION FROM REMAINING.

11/06/18

Answer any five question from following .

[15 Marks]

- 1.A. What is mean by E pollution?
- 1.B. Explain concept of carbon credit.
- 1.C. explain the concept of ecological pyramid.
- 1.D. Differentiate between conventional and non conventional energy
- 1.E. Explain food chain.
- 1.F. Explain causes and effect of Ozone layer depletion.
- 1.G. Explain the concept of acid rain.

Answer any three question from following .

2.

[15 Marks]

- A. Explain various modes needed for public awareness to protect earth from environmental degradation .
- B. Explain need and importance of Environmental studies?
- C. Explain the classification of ecosystem.

3

[15 Marks]

- A. How electricity is generated by using wind energy?
- B. State and explain principal, construction and working of flat plate collector used for solar energy.
- C. What are the limitations of conventional sources of energy?

4.

[15 Marks]

- A. What are green buildings? what are the advantages of green structure?
- B.. Discuss various indoor air pollutants
- C. What is the role of disaster management?

5.

[15 Marks]

- A. Discuss briefly about green house effect.
- B. What are the main causes of soil degradation?
- C. What are the measures to control the global warming ?

6.

[15 Marks]

- A. Discuss the role of 3R in sustainable development.
- B. How increasing population is exerting extra pressure on land and mineral resource discuss.
- C. What do you mean by land filling? Explain briefly.

Total Marks: 80

Hours: 3 hrs

- Note:** 1. Question no. 1 is compulsory.
2. Attempt any **three** questions out of remaining **five** questions.

Q.1. [a] Evaluate $\int_0^{\infty} 5^{-4x^2} dx$. [3]

[b] Solve $\frac{dy}{dx} = xy$ with the help of Euler's method, given that $y(0) = 1$,
and find y when $x = 0.3$ ($h = 0.1$). [3]

[c] Evaluate $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = 0$. [3]

[d] Evaluate $\int_0^1 \sqrt{\sqrt{x} - x} dx$. [3]

[e] Solve $(1 + \log xy)dx + \left(1 + \frac{x}{y}\right)dy = 0$. [4]

[f] Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dx dy}{1+x^2+y^2}$. [4]

Q.2. [a] Solve $xy(1 + xy^2)\frac{dy}{dx} = 1$. [6]

[b] Find the area inside the circle $r = a \sin \theta$ and outside the cardioid
 $r = a(1 + \cos \theta)$. [6]

[c] Apply Runge-kutta Method of fourth order to find an approximate
value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$ when $y = 1$ at $x = 0$
with step size $h = 0.2$. [8]

Q.3. [a] Show that the length of the curve $9ay^2 = x(x-3a)^2$ is $4\sqrt{3}a$. [6]

[b] Change the order of the integration of $\int_0^1 \int_{-\sqrt{2y-y^2}}^{1+\sqrt{1-y^2}} f(x, y) dx dy$. [6]

[c] Find the volume of the paraboloid $x^2 + y^2 = 4z$ cut off by the
plane $z = 4$. [8]

Q.4. [a] Show that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(a+1)$. [6]

[b] If y satisfies the equation $\frac{dy}{dx} = x^2y - 1$ with $x_0 = 0, y_0 = 1$, using
Taylor's Series Method find y at $x=0.1$ (take $h=0.1$). [6]

[c] Find the value of the integral $\int_0^1 \frac{x^2}{1+x^3} dx$ using (i) Trapezoidal rule [8]
(ii) Simpson's 1/3rd rule (iii) Simpson's 3/8th rule.

Q.5.[a] Solve $(y - xy^2)dx - (x + x^2y)dy = 0$. [6]

[b] Evaluate $\iiint \sqrt{1 - \frac{x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2}} dx dy dz$ over the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$. [6]

[c] Evaluate $(2x + 1)^2 \frac{d^2y}{dx^2} - 2(2x + 1) \frac{dy}{dx} - 12y = 6x$. [8]

Q.6. [a] A resistance of 100 ohms and inductance of 0.5 henries are connected in series with a battery of 20 volts. Find the current at any instant if the relation between L, R, E is $L \frac{di}{dt} + Ri = E$. [6]

[b] Solve by variation parameter method $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{x^*}$. [6]

[c] Evaluate $\iint xy(x - 1)dx dy$ over the region bounded by $xy = 4$, [8]

$y = 0$, $x = 1$ and $x = 4$.

Q. P. Code: 24185

[Time: 2 Hours]

[Marks: 60]

N.B. 1) Question no. 1 is compulsory

2) Solve any 3 questions from question no. 2 to 6.

3) Assume suitable data wherever required.

4) Figures to right indicate full marks.

21/05/18

Q.1. Solve any five from the following.

(15M)

- Explain how interference in wedge shaped film is used to test optical flatness of given glass plate.
- What is diffraction grating? What is the advantage of increasing the number of lines in the grating?
- With neat ray diagram explain the concept of total internal reflection (TIR).
- Differentiate between spontaneous and stimulated emission.
- Find cylindrical coordinates of a point $(3\hat{i} + 4\hat{j} + \hat{k})$.
- In Newton's rings pattern what will be the order of the dark ring which will have double the diameter of the 40th dark ring.
- Draw the block diagram of cathode ray tube (CRT) and briefly explain functions of its parts.

Q.2

- Derive the conditions for maxima and minima due to interference of light reflected from thin film of uniform thickness. (8M)
- Derive the formula for numerical aperture of step index fibre and give its physical significance. The N.A. of an optical fibre is 0.5 and core refractive index is 1.54. Find the refractive index of cladding. (7M)

Q.3

- Discuss the Fraunhofer diffraction at single slit and obtain the condition for minima. In plane transmission grating the angle of diffraction for second order principal maxima for wavelength 5×10^{-5} cm is 35° . Calculate number of lines /cm on diffraction grating. (8M)
- What is the difference between photography and holography? Explain holography technique to obtain 3-D image of an object. (7M)

Q.4

- Find the divergence of vector field $\vec{F} = x^2yz\hat{i} + xz\hat{j}$ (5M)
- Explain how A.C. voltage and its frequency is measured using CRO. (5M)
- A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between consecutive bright fringes is 0.12 cm. Calculate wavelength of light used. (5M)

Q.5

- a) Explain Newton's rings experiment and show that diameters of n^{th} dark rings are proportional to square root of natural numbers.
b) Write Maxwell's equations and give its physical significance.
c) Explain construction and working of atomic force microscope.

(5M)

(5M)

(5M)

Q.6

- a) Explain different types of carbon nanotubes and give its applications.
b) Explain construction and working of Nd:YAG laser.
c) Write a note on electrostatic focussing.

(5M)

(5M)

(5M)

[Time: 02 Hours]

[Marks:60]

Please check whether you have got the right question paper.

25/05/18

- N.B:
- 1) Questions no.1 is compulsory.
 - 2) Attempt any three questions from remaining five questions.
 - 3) Figures to the right indicate full marks.
 - 4) Atomic alt:-Al=27, Ca=40, S=32, Cl=35.5, Fe=56, K=39, C=12, N=14, O=16, Na=23, Mg=24.

Q.1 Attempt any five of the following

15

- (a) Define power alcohol. Give any two advantages of power alcohol.
- (b) Explain why cathodic coating is preferred over anodic coating for manufacturing of containers to store food stuffs.
- (c) A sample of coal has the following composition:-

C = 70%, O = 23%, H = 5%, S = 1.5%, N = 0.4%, Ash = 0.1%,

calculate the G.C.V. of this fuel.

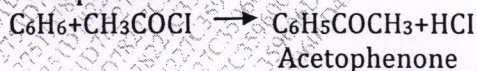
- (d) Give the composition, properties and uses of high phosphorus bronze.
- (e) Why is it essential to design safer chemicals and products w.r.t. green chemistry principle? Explain with an example.
- (f) What is the matrix phase and particle phase in concrete? Give any two properties of concrete.
- (g) Porous film is also called as 'Non protective film'. Explain with an example.

Q.2

- (a) Define electrochemical corrosion. Explain Intergranular corrosion with a neat labelled diagram. 06
- (b) i) 1.95 gm of a coal sample was taken for nitrogen estimation by Kjeldahis's method. The ammonia liberated required 9.5ml of 0.4 N H₂SO₄ for neutralisation. Calculate the percentage of Nitrogen in coal sample. 03
- ii) Write a note on Green solvents 02
- (c) Explain the structural composition of plywood. 04

Q.3

- (a) Define fuel cell. Explain Hydrogen Oxygen fuel cell with a neat labelled diagram. 06
- (b) i) Define shape memory Alloy. Give its properties and uses. (Any two) 03
- ii) Define Bio-Diesel and give its advantages. 02
- (c) Calculate the % atom economy of the following reaction w.r.t. the product acetophenone. 04



TURN OVER

- Q.4 (a) What is cathodic protection? Explain impressed current cathodic protection with its applications. 06
 (b) i) What is Green chemistry? Give its significance. 03
 ii) Define composite. Give any two applications of composite material 02
 (c) What is powder metallurgy? Explain hot compaction method with a neat labeled diagram. 04
- Q.5 (a) A gaseous fuel contains $H_2 = 50\%$, $CH_4 = 30\%$, $N_2 = 2\%$, $CO = 7\%$, $C_2H_4 = 3\%$, $C_2H_6 = 5\%$, and watervapour = 3% . Calculate weight and volume of air required for $2m^3$ of the gas. [Given: Mol. Wt. of an air = $28.949kg$] 06
 (b) i) List the three main constituents of paint and give functions of each. 03
 ii) Explain the effect of the following alloying elements on steel. 02
 a) Chromium b) Tungsten
 (c) Explain conventional and Green chemistry route for production of Ibuprofen Highlight the green chemistry principle involved. 04
- Q.6 (a) Write short notes on:- 06
 a) Computing b) Sintering
 (b) i) What are Fiber Reinforced composite 03
 ii) Explain how areas of anode and cathode effect the rate of corrosion 02
 (c) Explain the determination of % moisture and % volatile matter in a coal sample. 04

12/06/18.

(3 Hours)

[Total Marks:60]

- Solve any **FOUR** questions.
- All dimensions are in mm.
- Use first angle method of projection.
- Assume suitable dimension if it is necessary.
- Retain all construction lines.

Q.1

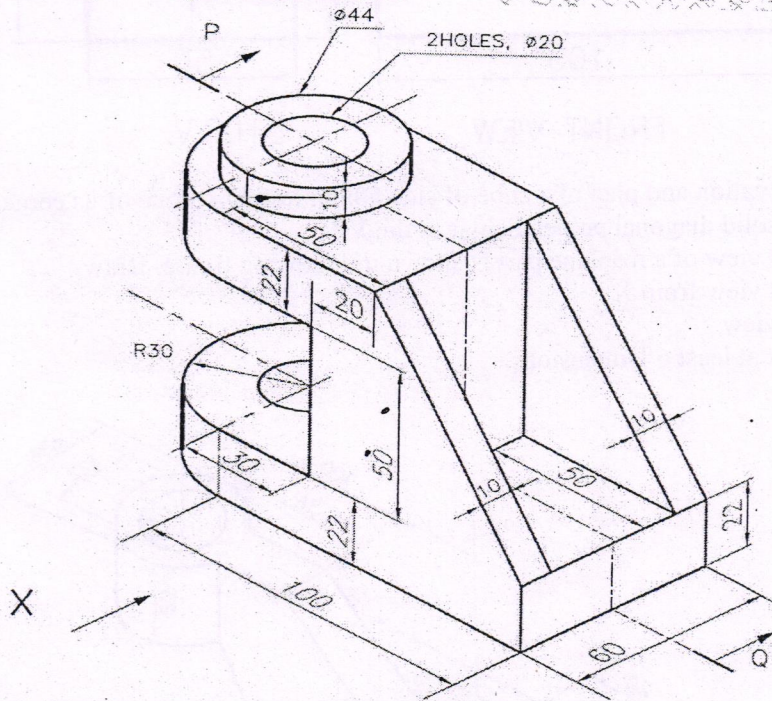
Following figure shows the pictorial view of an object, draw

- Sectional front view along section P-Q
- Top view.
- Right Hand Side view

[5]

[4]

[4]



iv.) Insert 10 major dimensions

[2]

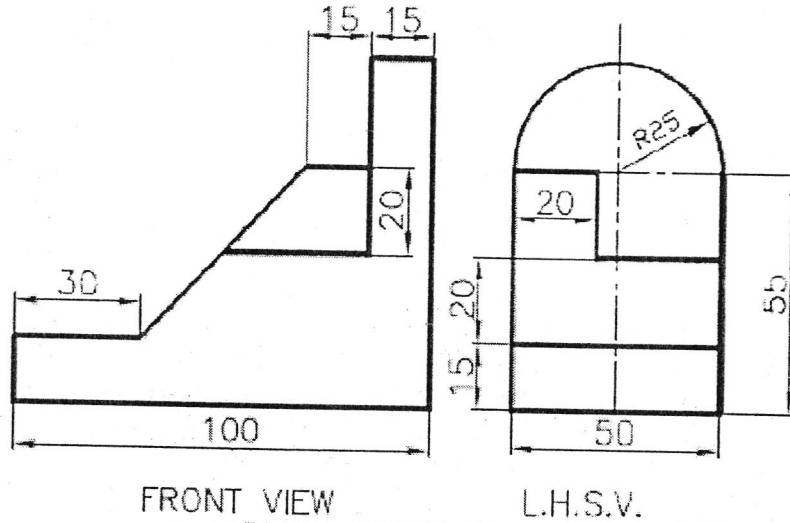
Q.2 A pentagonal pyramid of base 35mm and height 70mm is having one of its base edge in HP with triangular surface containing this edge perpendicular to HP, parallel to VP and away from observer. Draw its projections.

[15]

[TURN OVER]

Q.3 (a) Front view and side view of an object is shown in figure, draw an Isometric View.

[8]



FRONT VIEW

L.H.S.V.

(b) Draw the elevation and plan of a cube of side 50mm resting on one of its corner of base on HP with solid diagonal perpendicular to the VP. [7]

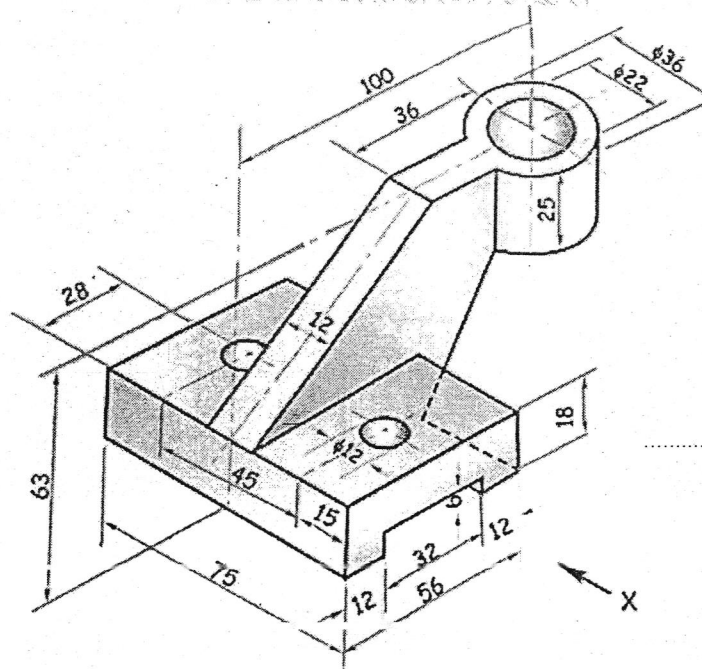
Q.4 (a) The pictorial view of a machine part is shown in following figure. Draw

- Front view from X
- Top view
- Insert at least 6 Dimensions.

[4]

[4]

[1]

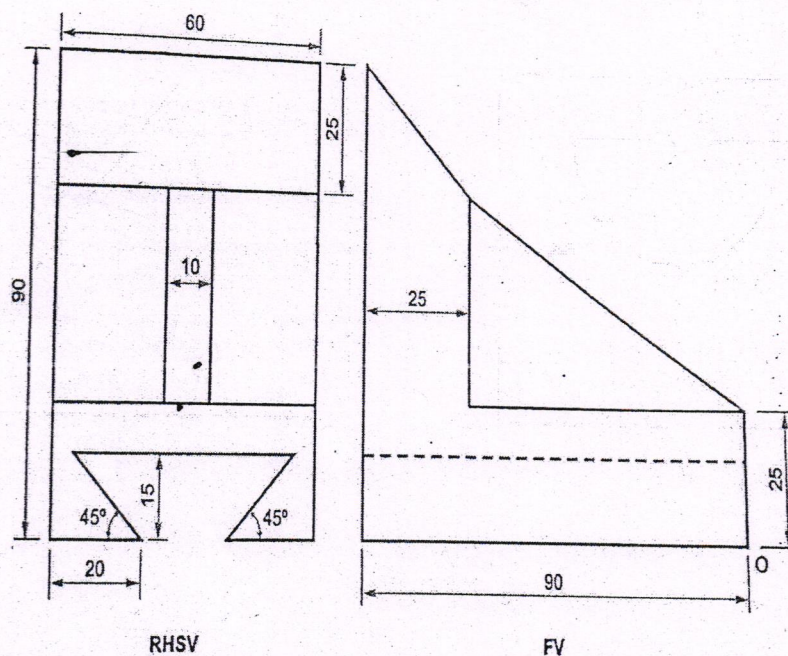


(b) Draw 1.5 revolution of a cylindrical helix of pitch 60mm on a cylinder of 50mm diameter.

[6]

[TURN OVER

- Q.5 A right circular cone having diameter of base 60mm, axis length 80mm resting on its base on HP is cut by cutting plane perpendicular to VP and inclined to HP at 60° , bisects the axis. Draw its FV, sectional TV and the true shape of section. Also draw the development of lateral surface of the cone after removing the portion containing the apex. [15]
- Q6 (a) End A of line AB is in second quadrant and is 40mm and 15mm from HP and VP respectively. The line is inclined at 40° to both the reference planes. Draw its projection when end B is in third quadrant and 45mm from HP. Find true length and distance of end B from VP. [8]
- (b) Front view and sideview of an object are shown in figure, draw an isometric view. [7]



SPA - 31/05/2018

N.B

- (1) Question no. 1 is compulsory.
- (2) Attempt any 3 from the remaining questions.
- (3) Assume suitable data if necessary.
- (4) Figures to right indicate full marks.

(3 Hours)

[Max. Marks 80]

- Q.1 (a) Select the correct option from multiple choice questions. 10
- i. Which bitwise operator is used to multiply the number by 2^n where n is number of bits.
A] Bitwise-OR B] Bitwise-AND C] Bitwise Left shift D] Bitwise Right Shift
 - ii. Which operator has the lowest priority?
A] ++ B] % C] + D] ||
 - iii. Which of these is a valid variable declaration?
A] int emp salary; B] float marks_student; C] float roll-no; D] int main;
 - iv. What will be the output of the following program?

```
void main ( ) {
double x=28;
int r;
r= x%5;
printf ("\\n r=%d", r); }
```

A] r= 3 B] Run time Error C]Compile time Error D]None of the Above
 - v. What will be the output of the following program?

```
void main( ) {
int x []= {10,20,30,40,50};
printf ("\\n %d %d %d %d", x [4] ,3[x] ,x[2] ,1[x] ,x[0] ); }
```

A]Error B]10 20 30 40 50 C]50 40 30 20 10 D]None of these
 - vi. Which of the following is not a keyword of 'C' ?
A]auto B]register C]int D]function
 - vii. What will be the output ?

```
void main ( ) {
int y ;
y=0x10+ 010+10;
printf ("\\ny=%x", y); }
```

A] y = 34 B] x = 34 C] y = 22 D]Error

Study the following C program

viii.

```
void main ( ) {  
    int a=0;  
    for ( ; a );  
    a++; }
```

what will be the value of the variable a, on the execution of the above program

A] 1 B] 0 C] -1 D] none of these

Which of the following is used as a string termination character?

ix. A] 0 B] \0 C] /0 D] None of these

What will be the output of the following program code?

x.

```
void main ( ) {  
    char a[] = "Hello World";  
    char *p;  
    p=a;  
    printf("\n%d %d %d %d", sizeof(a), sizeof(p), strlen(a), strlen(p)); }
```

A] 11 11 10 10 B] 10 10 10 10 C] 12 12 11 11 D] 12 2 11 11

Q.1 b

State True or False with reason.

10

- i. Size of pointer variable is equal to the datatype it points to.
- ii. A float constant cannot be used as a case constant in a switch statement.
- iii. The statement `void p;` is valid.
- iv. `while (0);` is an infinite loop.
- v. `scanf()` function is used to input string having multiple words
- vi. A function can have any number of return statements.
- vii. In a union, space is allocated to every member individually.
- viii. An algorithm is a graphical representation of the logic of a program.
- ix. Comments in the program make debugging of the program easier.
- x. There is no difference between '\0' and '0'.

Q.2 a. i. How to create array of structure variables and assign values to its members? 5

ii. Differentiate between struct and union. When is union preferred over struct? 5

Give one example of each.

Q.2 b. i. WAP to print the sum of the following series: 5

$1 + 2^2 + 3^3 + \dots + n^n$

ii. Compare the following: 5

i) break and continue statements

ii) if-else and switch statements

Q.3 a. Write a program to calculate number of vowels (a, e, i, o, u) separately in the entered string. 6

b. Predict output of following program segment. 4
[Note: Show pictorial representation]


```
(i)main()
{
    int a,b,*p1,*p2,x,y;
    a=48;b=10;p1=&a;p2=&b;
    x=*p1**p2-8;
    *p1=*p1+*p2;
    y=(*p1/*p2)+20;
    printf("%d %d %d %d %d %d", *p1,*p2,a,b,x,y);
}
```

```
(ii)
main()
{
    int x=4,y=9,z;
    z = x++ + --y +y;
    printf("\n %d %d %d",x,y,z);
    z= --x + x+ y--;
    printf("\n %d %d %d",x,y,z);
}
```

- c. An electronic component vendor supplies three products: transistors, resistors and capacitors. The vendor gives a discount of 10% on order for transistors if the order is more than Rs. 1000. On order of more than Rs. 100 for resistors, a discount of 5% is given and discount of 10% is given on orders for capacitors of value more than Rs. 500. Assume numeric code 1, 2 and 3 used for transistors, capacitors and resistors respectively. Write a program that reads the product code and the order amount, and prints out the net amount that the customer is required to pay after discount. (Note: Use switch-case) 10

- Q.4 a. What is recursion? WAP using recursion to find sum of array elements of size n. 10
 Q.4 b. Write a C program to 10

- i. Create a 2D array (Matrix) [in main function]
- ii. Write a function to read 2D array(Matrix)
- iii. Write a function that will return true(1) if entered matrix is symmetric or false(0) is not symmetric.
- iv. Print whether entered matrix is symmetric or not [in main function]

- Q.5 a. Implements string copy function STRCOPY (str1, str2) that copies a string str1 (source) to another string str2 (destination) without using library function. 05
 b. Explain File handling in c in detail. [Note: Mention file types, file modes, file related functions and its use] 08

c. WAP to print all possible combinations of 1, 2, 3 using nested loops. 07

Q.6 a. WAP to print following pattern for n lines. [Note: range of n is 1-9] 05

```
1
121
12321
1234321
```

b. WAP to print binary equivalent of entered decimal no. 05

c. What is significance of storage classes? Explain it with relevant examples. 10

(2 Hours)

Total marks: 40

N. B. (1) Question No 1 is compulsory

06/06/18

(2) Attempt any three out of Five questions

1. (a) List 2 situations which could occur in your personal life where you would choose to speak rather than write. Explain the reasons for your choice. (3)
(b) Give the diagrammatic representation of Complete Block Form (2)
(c) Explain the relevance of diagrams while describing an object (2)
(d) Techniques to improve listening skills (3)
2. (a) Explain Proxemics (3)
(b) Write short notes on completeness (2)
(c) When is Note given in instructions? (2)
(d) Find one word substitutes for the following phrases: (3)
(i) An instrument for measuring earthquakes S-----
(ii) To move from one country to another M-----
(iii) Murder of a new born child I-----
3. (a). How is courtesy shown in business letters? Give at least two examples. (2)
(b). Meera Biscuits Mart, Lonavala have complained that they received a consignment of 100 kg of biscuits in a broken condition and have asked for adjustment. They have attributed the damage to defective packaging. On behalf of Shandesh Biscuits and Food Products, Mumbai write a suitable reply. (6)
(c). What is the importance of Feedback in Communication process? (2)
4. (a). Distinguish between oral and written communication. (2)
(b). Give the difference in meaning for each of the following pairs of words: (2)
(i) Various , varied
(ii) Climate , weather
(c) Your company is organizing a two day conference in New Delhi and you expect Sales Personnel from branches all over India to attend. As the Convener of the conference write to a hotel enquiring about facilities like conference hall, food and accommodation the participants. Give necessary details. (6)
5. (a). Write short notes on: (4)
(i). Chronemics
(ii). 'Precaution' in Instructions
(b). Describe Any One of the following objects: (4)
(i). Head Phones
(ii). Scanner

Turn Over

(c). Give the diagrammatic representation of Communication Cycle. (2)

6. (a) Read the following passage and answer the questions given below:

But man is not destined to vanish. He can be killed, but he cannot be destroyed, because his soul is deathless and his spirit is irrepressible. Therefore, though the situation seems dark in the context of the confrontation between the superpowers, the silver lining is provided by amazing phenomenon that the very nations which have spent incalculable resources and energy for the production of deadly weapons are desperately trying to find out how they might never be used. They threaten each other, intimidate each other and go to the brink, but before the total hour arrives they withdraw from the brink.

i. The main point from the author's view is that (01)

- A. Man's soul and spirit cannot be destroyed by superpowers.
- B. Man's destiny is not fully clear or visible.
- C. Man's soul and spirit are immortal.
- D. Man's safety is assured by the delicate balance of power in terms of nuclear weapons.
- E. Human society will survive despite the serious threat of total annihilation.

ii. The phrase 'Go to the brink' in the passage means (01)

- A. Retreating from extreme danger.
- B. Declare war on each other.
- C. Advancing to the stage of war but not engaging in it.
- D. Negotiate for peace.
- E. Commit suicide.

iii. In the author's opinion (01)

- A. Huge stockpiles of destructive weapons have so far saved mankind from a catastrophe.
- B. Superpowers have at last realized the need for abandoning the production of lethal weapons.
- C. Mankind is heading towards complete destruction.
- D. Nations in possession of huge stockpiles of lethal weapons are trying hard to avoid actual conflict.
- E. There is a Silver lining over the production of deadly weapons.

iv. 'Irrepressible' in the second line means (01)

- A. incompatible
- B. strong
- C. oppressive
- D. unrestrainable
- E. unspirited

v. A suitable title for the above passage is (01)

- A. Destruction of mankind is inevitable.
- B. Man's desire to survive inhibits use of deadly weapons.
- C. Mounting cost of modern weapons.
- D. Threats and intimidation between super powers.
- E. Cowardly retreat by man

6. (b). List any Ten Instructions to follow while welding an object. (05)