Total No. of Questions : 8]

SEAT No. :

P4354

[Total No. of Pages : 3

[5458]-101

F.E.

ENGINEERING MATHEMATICS - II

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Assume suitable data, if necessary.***
5) ***Attempt Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***

Q1) a) Solve the following differential equations.

i) $\frac{dy}{dx} = 1 - x\tan(x - y)$ **[4]**

ii) $\frac{dy}{dx} = \frac{y+1}{(y+2)e^{y} - x}$ **[4]**

b) A particle of mass m falls under gravity in a fluid whose resistance to motion at any instant is mk times the velocity where k is constant. Find the terminal velocity of the body. **[4]**

OR

Q2) a) Solve $\frac{dy}{dx} + y\cot x = \sin 2x.$ **[4]**

b) i) A body of temperature 100°c is placed in a room whose temperature is 20°c and cools to 60°c in 5 minutes. What will be its temperature after 10 minutes? **[4]**

ii) A resistance of 250 ohms and an inductance of 640 H are connected in series with a battery of 500 volts. Find the current in the circuit if i = 0 at t = 0. **[4]**

P.T.O.

Q3) a) Find the Fourier series to represent the function $f(x) = x$ in the interval $-\pi < x < \pi$ and $f(x + 2\pi) = f(x)$. **[5]**

b) Evaluate $\int_0^\infty x^9 e^{-2x^2} dx$. **[3]**

c) Trace the curve (Any ONE) **[4]**

i) $y^2(a + x) = x^2 (a - x)$

ii) $r = a (1 + \sin\theta)$

OR

Q4) a) Establish reduction formula for $I_n = \int_0^{\pi/4} \sec^n \theta \ d\theta$. **[4]**

b) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(1 + a)$, $a \geq 0$ **[4]**

c) Find complete arclength of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$. **[4]**

Q5) a) Show that the spheres $x^2+y^2+z^2=25$ and $x^2+y^2+z^2-18x-24y-40z+225=0$. touch externally and find their point of contact. **[5]**

b) Find the equation of right circular cone which has its vertex at (0,0,10) and whose intersection with the XOY-plane is a circle of radius 5. **[4]**

c) Find the equation of right circular cylinder of radius 3 whose axis is the line : **[4]**

$$\frac{x-1}{2} = \frac{y-3}{2} = \frac{z-5}{-1}$$

OR

Q6) a) Show that the plane $2x - 2y + z + 12 = 0$ touches the sphere

$x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$. Also find the point of contact. **[5]**

b) Find the equation of right circular cone with vertex at origin, axis is the y-axis and semi-vertical angle of 30°. **[4]**

c) Find the equation of right circular cylinder of radius 2 whose axis passes through (1, 2, 3) and has direction ratios 2, 1, 2. **[4]**

Q7) Attempt any two of the following :

a) Evaluate, $\int_0^{a/\sqrt{2}} \int_0^{\sqrt{a^2-y^2}} \log_e \left(x^2+y^2\right)\, dx\, dy$ **[6]**

b) Evaluate, $\iiint \frac{dx\, dy\, dz}{\sqrt{1-x^2-y^2-z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$. **[7]**

c) Find the moment of inertia about the line $\theta=\frac{\pi}{2}$ of the area enclosed by $r = a\ (1 + \cos\theta)$. **[6]**

OR

Q8) Attempt any two of the following :

a) Find the total area included between the two cardiodes $r = a\ (1 + \cos\theta)$ and $r = a\ (1 - \cos\theta)$. **[6]**

b) Find volume of the region bounded by paraboloid $x^2 + y^2 = 2z$ and the cylinder $x^2 + y^2 = 4$. **[7]**

c) Find the centroid of one loop of the Laminscate $r^2 = a^2 \cos 2\theta$. **[6]**

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Total No. of Questions : 8]

SEAT No. :

P4355

[Total No. of Pages : 4

[5458]-102

F.E. (All)

ENGINEERING MECHANICS

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat sketches must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator is allowed in the examination.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) A trolley is acted upon by two forces as shown **Fig. 1a.** If $\theta = 25°$ and the resultant R of the two forces is vertical, then determine the magnitude of the force P and resultant R. **[6]**

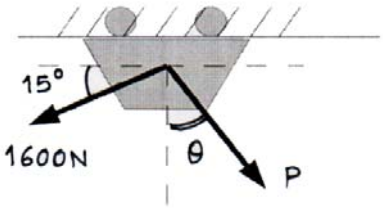

Fig. 1a

b) A stone thrown vertically upward from earth returns to the earth in 5 sec. How high does the stone reached. Also determine the velocity with which it is thrown. **[6]**

OR

Q2) a) Locate the centroid of the plane lamina as shown in **fig. 2a.** **[6]**

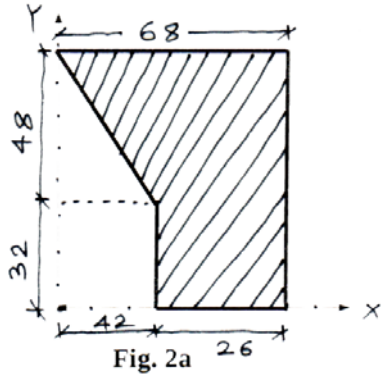

Fig. 2a

P.T.O.

b) An 80 kg block rests on a rough horizontal plane as shown in the **Fig.2b.** Find the magnitude of the force 'P' required to give an acceleration of 2.5 m/s^2 to the right. Take coefficient of kinetic friction as 0.25. **[6]**

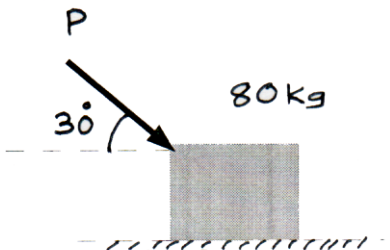

Fig. 2b

Q3) a) A ball is thrown by a player from 5 m above ground level, clears the 25m high wall placed 100 m from the player. If the angle of projection of the ball is 60 degrees, then determine the initial velocity of the ball. **[6]**

b) A 30 kg block dropped from a height of 2 m onto the 10 kg pan of spring scale as shown in the **Fig. 3b.** Assuming the collision to be perfectly plastic. Determine the maximum deflection (Compression of the pan. The spring constant is k = 20 kN/m. **[6]**

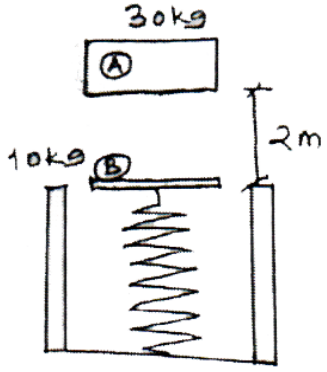

Fig. 3b

OR

Q4) a) The polar coordinates of a particle moving along a plane curve are given by $r = t^3 - 3t + 10$ and $\theta = (0.5r)$, where 'r' is in meters, 'θ' is in radians and 't' is in seconds. Determine the acceleration of the particle at $t = 2$ sec. **[6]**

b) A 20 Mg railroad car moving with 0.5 m/s speed to the right collides with a 35 Mg car which is at rest. If after the collision the 35 Mg car is observed to move right with a speed of 0.3 m/s, determine the coefficient of restitution between the two cars. **[6]**

Q5) a) The beam AB with pin at 'A' and roller at 'B' loaded as shown in the **Fig. 5a.** Determine the reactions at the supports A &B. **[6]**

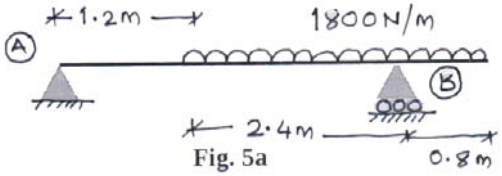

Fig. 5a

b) Three cables are used to support a container as shown in the **Fig. 5b.** Determine the tension in the cables AB, AC and AD if the weight of the container is 1000N. **[7]**

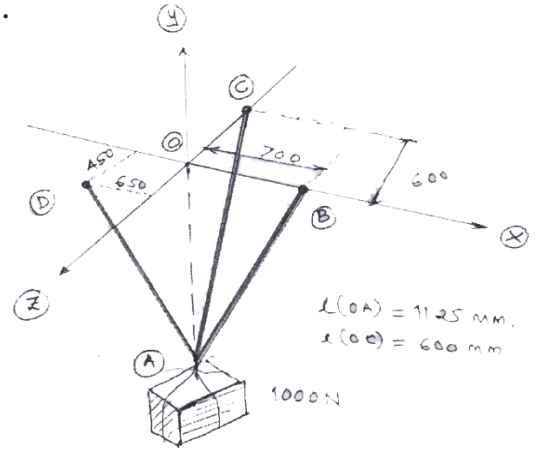

Fig. 5b

OR

Q6) a) Determine the reactions at all the point of contacts for a sphere of 200 N kept in a trough as shown in the **Fig. 6a.** **[6]**

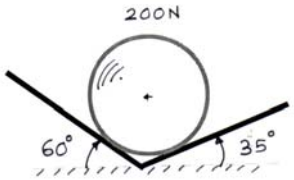

Fig. 6a

b) The square mat foundations supports four columns as shown in the **Fig.6b.** Determine the magnitude and position of the resultant force w.r. to origin 'O'. **[7]**

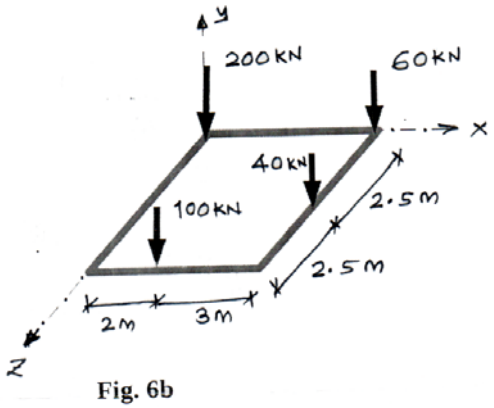

Fig. 6b

Q7) a) The truss supports vertical loads as shown in **Fig. 7a.** Determine the forces in all the members of the truss and state the nature of the forces in tabular form. **[7]**

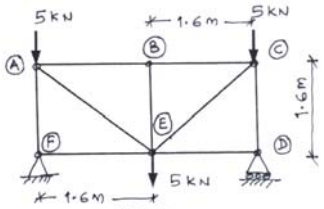

Fig. 7a

b) The hawser thrown from ship to a pier is wrapped by two full turns around the capstan as shown in the **Fig. 7b.** If the tension in the hawser is 7500 N and is maintained without slipping by exerting 150 N force on the free end. Determine the coefficient of friction between hawser and capstan. **[6]**

Fig. 7b

OR

Q8) a) The truss supported and loaded as shown in the **Fig. 7a.** determine the forces in the members AB, BF and EF using section method. Also give the nature of the forces. **[7]**

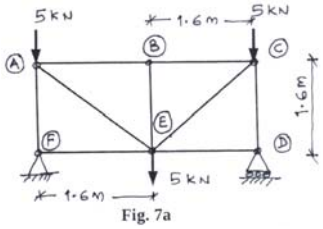

Fig. 7a

b) Cable ABC supports 65 kg and 75 kg loads at 'B' and 'C' points as shown in the **Fig. 8b.** Determine the magnitude of the force 'P' and distance 'a' to maintain equilibrium. **[6]**

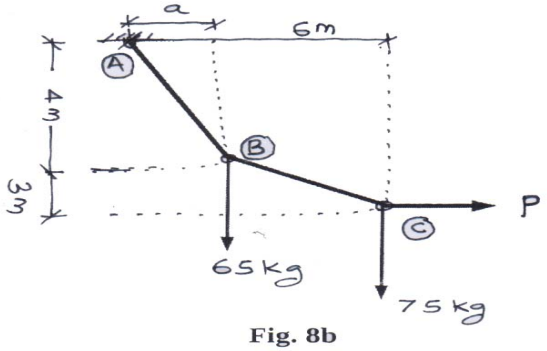

Fig. 8b

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Total No. of Questions : 8]

SEAT No. :

P4356

[Total No. of Pages : 2

[5458]-103

F.E. (Semester - I)

BASIC MECHANICAL ENGINEERING

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Assume suitable data, if necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of non-programmable electronic calculator is permitted.***
5) ***Attempt four questions out of eight. Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***

Q1) a) Draw neat sketches of ball bearing & disc brake. **[6]**

b) Explain any six mechanical properties of material. **[6]**

OR

Q2) a) compare belt drive, chain drive and spur gear drive on the basis of Elements of drive, centre distance, Power transmitting capacity and Application. Draw simplified diagram of cross section of flat belt with pulley and cross section of V belt with Pulley. **[6]**

b) Draw self-explanatory diagrams of four bar mechanism & slider crank mechanism. State their application. **[6]**

Q3) a) Differentiate between hot & cold working process. (Four points). Draw neat sketch of hot forging process setup. **[7]**

b) Draw self-explanatory diagrams of cylindrical grinding, surface grinding and centre less grinding process. **[6]**

OR

Q4) a) Explain any three sheet metal working process with neat sketches. **[6]**

b) Draw block diagram of a lathe machine. Explain function of headstock, tailstock and carriage of lathe machine. **[7]**

P.T.O.

Q5) a) State & explain two statements of second law of thermodynamics. **[4]**

b) Define atmospheric pressure, gauge pressure, absolute pressure and state units of pressure. **[4]**

c) A reversible heat engine operates with efficiency of 30%. Find the heat supplied and power output if heat rejected from the engine is 70 kW. Estimate COP of heat pump if the engine is reversed to work as heat pump. Draw sketch of the heat engine and heat pump. **[5]**

OR

Q6) a) Discuss limitations of first law of thermodynamics with two examples. **[4]**

b) Explain the following. **[4]**

i) Open System and Isolated System.

ii) Intensive properties and Extensive properties.

c) The pressure of gas flowing through a pipe is to be measured with simple U-tube manometer containing water. Left arm of manometer is connected to the pipe while right arm is open to atmosphere. Water level in left arm is 60 cm higher than water level in right-arm. Calculate gauge pressure & absolute pressure of the gas. Draw sketch of the barometer and U tube manometer setup. **[5]**

Given: Density of water = 1000 kg/m^3

Specific gravity of mercury = 13.6

Acceleration due to gravity = 9.81 m/s^2

Atmospheric pressure = 750 mm of mercury column.

Q7) a) Explain working of wind power plant. State its limitations. **[6]**

b) Explain working principle of four stroke cycle; compression ignition; C I (or Diesel) engine. **[6]**

OR

Q8) a) Draw block diagrams of nuclear power plant and hydro-electric power plant. **[6]**

b) What is refrigeration? Explain working of vapour compression refrigeration cycle. **[6]**

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Total No. of Questions : 8] **SEAT No. :**

P4399 **[Total No. of Pages : 2**

[5458]-104
F.E.
ENGINEERING CHEMISTRY
(2015 Pattern) (Theory) (Credit System)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain demineralization method of water softening with reactions and neat labelled diagram. **[6]**

b) Explain conductometric titration curve in case of strong acid & strong base. **[3]**

c) Define following terms : **[3]**

i) Chromophore

ii) Auxochrome

iii) Bathochromic shift.

OR

Q2) a) Explain procedure and reaction involved in potentiometric titration of Fe^{+2} Vs Ce^{+4} along with titration curve. Write the formulae for calculating emf of the cell before and after equivalence point of titration. **[6]**

b) Write merits and demerits of greener and traditional synthesis respectively of polycarbonate. **[3]**

c) 100 ml of alkaline water sample when titrated against 0.02N HCl, phenolphthalein end point obtained at 20ml addition of acid while further 15 ml acid required to get Methyl orange end point. Identify type of alkalinity and determine its extent. **[3]**

P.T.O.

Q3) a) Define vulcanization. Explain the vulcanization process with reaction & advantages of vulcanized rubber over natural rubber. **[6]**

b) What is power alcohol? Write its advantages and limitations. **[3]**

c) A coal sample contains 72%C, 10%H, 2%S, 1%O and remaining is ash. Calculate quantity of air required for complete combustion of 1kg of coal. **[3]**

OR

Q4) a) Explain Bomb calorimeter with principle, construction, working and neat labelled diagram. State formula with corrections to calculate GCV. **[6]**

b) Distinguish between thermosoftening and thermosetting polymer with example. **[3]**

c) What is Biodegradable polymer? Draw the structure of PHBV and write its applications. **[3]**

Q5) a) Give the isotopes of hydrogen with their applications and write the properties of hydrogen which makes it more difficult to state and transport. **[6]**

b) Explain structure of Graphite with its properties and applications. **[4]**

c) Write three isotopes of carbon with their applications. **[3]**

OR

Q6) a) Explain structure, properties and applications of fullerene. **[6]**

b) Explain production of Hydrogen by water splitting using solar energy. **[4]**

c) Write synthesis, properties and applications of silane. **[3]**

Q7) a) Discuss electrochemical corrosion by H_2 - evolution and O_2 - absorption mechanism. **[6]**

b) What is anodic coating? Explain galvanization with neat labelled diagram. **[4]**

c) State pilling-Bedworth ratio. Give its significance with example. **[3]**

OR

Q8) a) Define corrosion and explain any five factors affecting rate of corrosion. **[6]**

b) What is principle of cathodic protection? Explain it with any one suitable method. **[4]**

c) What are the types of metal oxide formed on following metals. i) Na ii) Ag iii) Mo and write the reactions involved in it. **[3]**

Total No. of Questions : 8]

SEAT No. :

P4357

[Total No. of Pages : 3

[5458]-105

F.E.

ENGINEERING PHYSICS

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) What is diffraction grating? For a plane transmission grating, starting from equation of resultant amplitude and intensity, specify the terms involved. Derive conditions of maxima and minima of diffraction pattern. **[6]**

b) For an empty hall, the reverberation time is found to be 1.5 sec. When curtain cloth of 20 m^2 is suspended in the hall, reverberation time reduces to 1 sec. If the dimensions of the halls are $10 \times 8 \times 6$ m^3, calculate the absorption of curtain cloth. **[3]**

c) Explain with a suitable diagram how the principle of interference is used in an anti-reflection coating. Derive an expression for its thickness. **[3]**

OR

Q2) a) What is reverberation? Give Sabine's formula for reverberation time. What are the factors affecting reverberation time? Explain how it can be optimized by controlling these factors. **[6]**

b) What is diffraction? Distinguish between Fresnel and Fraunhofer Diffraction (Any 2 points). **[3]**

c) Calculate the intensity level of a fighter plane just leaving the runway having a sound intensity of about 100 W/m^2. **[3]**

(Given: Threshold intensity $(I_0) = 10^{-12}$ W/m^2)

P.T.O.

Q3) a) Light is incident on a quartz crystal plate at normal incidence. Explain with suitable diagram the propagation of light in following cases when optic axis is lying in the plane of incidence and is **[6]**

i) Parallel to the crystal surface

ii) Perpendicular to the crystal surface

iii) Inclined to the crystal surface

b) Calculate the conductivity of Ge sample if the donor impurity is added to an extent of one part in 10^8 Ge atoms at room temperature. Data given: $N_a = 6.023 \times 10^{23}$ atoms/gm-mole, At. Wt. of Ge = 72.6, d = 5.32 gm./cc, μ =3800 cm^2/V-s, e= 1.6×10^{-19}C. **[3]**

c) Give any three distinguishing features between spontaneous emission and stimulated emission. **[3]**

OR

Q4) a) Explain Hall effect. Derive the expression for Hall voltage and Hall co-efficient. **[6]**

b) What is optical activity? State the formula for specific rotation and explain the terms involved in it. **[3]**

c) Calculate the band gap energy (in eV) in silicon, given that it is transparent to radiation of wavelength greater than 11000 AU. **[3]**

($h = 6.63 \times 10^{-34}$ J-sec, $c = 3 \times 10^8$ m/s)

Q5) a) Derive expression for the energy and wave function of a particle enclosed in an infinite potential well (rigid box). **[6]**

b) Obtain an expression for Heisenberg's Uncertainty Principle for energy and time. **[4]**

c) In a TV set electrons are accelerated by a potential difference of 10 KV. Calculate the de-Broglie wavelength matter waves associated with these electrons. **[3]**

($m_e = 9.1 \times 10^{-31}$kg, $h = 6.63 \times 10^{-34}$ J.s, $e = 1.6 \times 10^{-19}$C)

OR

Q6) a) State and explain Heisenberg's Uncertainty Principle. Show that it is also applicable for energy and time. **[6]**

b) Explain wave-function ψ. Give the physical significance of $|\psi^2|$. **[4]**

c) Calculate the lowest energy and corresponding momentum of an electron confined in a rigid box of width 2 Å. **[3]**
($e = 1.6 \times 10^{-19}$ C, $h = 6.63 \times 10^{-34}$ J-sec, $m_e = 9.1 \times 10^{-31}$ kg)

Q7) a) Explain chemical method for synthesis of nanoparticles by colloidal route with the help of LaMer diagram. Give one example of synthesis of metal nanoparticles. **[6]**

b) Give brief explanation of the optical properties of nanoparticles with the help of quantum confinement effect and G Mie equation. **[4]**

c) Explain the formation of Cooper pairs in superconductors with the help of electron phonon interaction. **[3]**

OR

Q8) a) What is superconductivity? Explain Meissner effect and show that superconductors are perfectly diamagnetic. **[6]**

b) Explain the following terms of superconductivity, **[4]**

i) Critical Magnetic Field

ii) Persistent Current

c) Give brief explanation of the magnetic properties of nanoparticles with the help of hysteresis curve. **[3]**

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Total No. of Questions : 8]

SEAT No. :

P4406

[Total No. of Pages : 2

[5458]-106

F.E.

BASIC ELECTRONICS ENGINEERING

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Figures to the right indicate full marks.***
2) ***Neat diagram must be draw wherever necessary.***
3) ***Use of electronic pocket calculator is allowed.***
4) ***Assume suitable data, if necessary.***
5) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***

Q1) a) Explain with neat circuit diagram bridge rectifier with its input and output waveforms. **[6]**

b) What is d.c. load line? Explain the role of 'Q' point on d.c. load line in BJT. **[6]**

OR

Q2) a) Draw and explain the working principle of photodiode and LED along with its characteristics. **[6]**

b) Define α, β and γ in CB, CE & CC configurations in BJT, if $\beta = 100$, calculate the value of 'α'. **[6]**

Q3) a) Draw the block diagram of op-amp and explain each block in brief. **[6]**

b) State and prove Demorgens theorem. **[6]**

OR

Q4) a) For Inverting amplifier using op-amp, if $R_f = 100k\Omega$, $R_1 = 10k\Omega$, $V_{cc} = \pm 10V$ & $V_{in} = 2V_{dc}$

i) Calculate output voltage

ii) Is the result in part (i) practically possible? Justify.

[6]

b) Implement Half adder using gates, truth table and give equations for sum & carry. **[6]**

P.T.O.

Q5) a) Define Transducer. Enlist various types of transducers. Explain with neat diagram the construction & working of LVDT. **[7]**

b) Draw Instrumentation system and explain the function of each block. **[6]**

OR

Q6) a) What are the types of temperature transducers. Explain in detail Thermo couple. **[7]**

b) Explain the operation of SCR with the help of V-I characteristics. **[6]**

Q7) a) Draw the block diagram of communication system and explain each block in brief. **[7]**

b) What is the need of Modulation? Explain modulation index for AM and FM techniques. **[6]**

OR

Q8) a) Write a short note on Wired communication. **[7]**

b) Draw and explain the block diagram of GSM. **[6]**

Total No. of Questions : 8]

SEAT No. :

P4358

[Total No. of Pages : 3

[5458]-107

F.E.

BASIC ELECTRICAL ENGINEERING

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn, wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Define the insulation resistance. Write down the expression for insulation resistance of the single core cable. State the factors on which it depends. **[6]**

b) Two coils, X of 12000 turns and Y of 15000 turns lie in parallel planes such that 60% of the flux produced by coil X links coil Y. A current of 5 A in coil X produces a flux of 0.05 mWb, while the same current in coil Y produces a flux of 0.075 mWb. Find : **[7]**

i) self-inductance of each coil

ii) mutual inductance

iii) coefficient of coupling

OR

Q2) a) What is magnetic circuit? For simple magnetic circuit without air gap, obtain the expression for flux. **[6]**

b) A filament lamp has a normal rating of 240V, 60W. If switched on at the room temperature of 20ºC to the 240V supply, it draws an initial current of 2.5A, calculate the temperature of filament in normal hot condition, if the temperature coefficient of resistance at 20ºC is 0.0055 per ºC. **[7]**

Q3) a) When two capacitance C_1 and C_2 are connected in series, derive the equation for total capacitance. Also draw circuit diagram. **[6]**

P.T.O.

b) A sinusoidal alternating quantity of 50 Hz frequency is having maximum value of current of 100 Amps. Find the time taken by current to attain **[6]**

i) 40A from origin and

ii) 70 A after passing through first positive maximum value.

OR

Q4) a) Write the equation of instantaneous voltage in terms of : **[6]**

i) Maximum voltage and coil angle θ

ii) Maximum voltage and angular velocity

iii) Maximum voltage and frequency

iv) Maximum voltage and Time period.

Draw the sinusoidal waveform of voltage vs time and show the maximum value, cycle, frequency and periodic time.

b) With neat sketches , explain the various types of lamination used for the construction of core of single phase transformer. **[6]**

Q5) a) Derive the relationship between the line values and phase values of voltage and current for balanced three phase **star connected inductive load** with the help of connection diagram and phasor diagram. Hence obtain the total power consumed. Assume phase sequence RYB. **[6]**

b) A R-C series circuit is connected across 100 V, 50 Hz supply draws a current of 5 A at a power factor 0.3 leading. Find the value of R and C. Also find power consumed. **[7]**

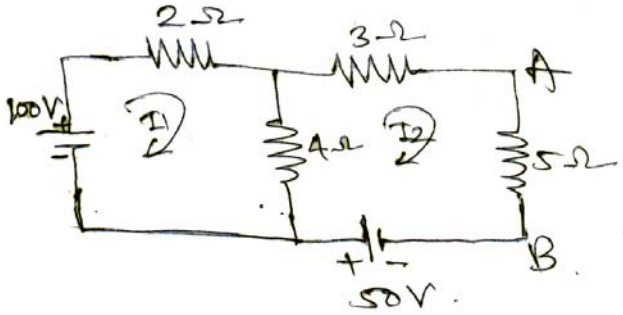
OR

Q6) a) What is admittance? Obtain its components and their units. Draw admittance triangle for R-L and R-C circuit. **[6]**

b) A coil of inductance 15 mH and resistance 25 Ω resistance is connected in series with a capacitor 'C' across 230 V, 50 Hz supply. Find the value of capacitor so that circuit draws maximum current. What will be the power factor and power consumed? **[7]**

Q7) a) Elaborate steps to be followed to obtain current through any branch using Thevenin's equivalent circuit. **[6]**

b) Find the current through branch AB using KVL. All resistances are in ohm. **[6]**



OR

Q8) a) With usual notation, derive step by step formulae for converting delta elements of the network to star elements on equivalence basis. **[6]**

b) Elaborate steps to be followed to obtain current through any branch using Superposition theorem. **[6]**

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Total No. of Questions : 8]

SEAT No. :

P4402

[Total No. of Pages : 3

[5458]-108

F.E.

ENGINEERING MATHEMATICS - I

(2015 Pattern) (Credit System)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Examine for consistency of system of equations **[4]**

$$x + y - 3z = -1$$

$$4x - 2y + 6z = 8$$

$$15x - 3y + 9z = 21$$

if consistent solve it.

b) Find eigen values of the matrix. **[4]**

$$\begin{bmatrix} 2 & 0 & -1 \\ 0 & 2 & 0 \\ -1 & 0 & 2 \end{bmatrix}$$

Also find eigen vector corresponding to smallest eigen value.

c) Two opposite vertices of a square are represented by complex numbers $9 + 12i$ and $-5 + 10i$. Find the complex number representing the other two vertices of the square. **[4]**

OR

Q2) a) Examine for Linear dependence or independence of vectors $x_1 = (3, 1, -4)$, $x_2 = (2, 2, -3)$, $x_3 = (0, -4, 1)$. If dependent find the relation between them. **[4]**

b) Solve $x^4 + x^3 + x^2 + x + 1 = 0$, by using DeMoivre's theorem. **[4]**

c) If $\sinh(\theta + i\phi) = \cos\alpha + i \sin\alpha$, prove that $\sinh^4\theta = \cos^4\phi$. **[4]**

P.T.O.

Q3) a) Solve any one : **[4]**

i) Test the convergence of the series $\sum_{n=1}^{\infty} \frac{(n+1)^n}{n!}$.

ii) Test the convergence of the series $\frac{1}{1+2^{-1}} + \frac{2}{1+2^{-2}} + \frac{3}{1+2^{-3}} + ...$

b) Prove that $\log(1+x+x^2+x^3+x^4) = x + x^2/2 + x^3/3 + x^4/4 - \frac{4}{5}x^5 + ...$ **[4]**

c) Find n^{th} derivative of $y = \frac{1}{(x-1)^2(x-2)}$. **[4]**

OR

Q4) a) Solve any one : **[4]**

i) Find a & b, if $\lim_{x\to 0} \frac{x(-a\cos x + 1) + b\sin x}{x^3} = \frac{1}{3}$.

ii) Prove that $\lim_{x\to\infty} \left(\frac{ax+1}{ax-1}\right)^x = e^{2/a}$.

b) Expand $2x^3 + 7x^2 + x - 6$ in powers of $(x - 3)$. **[4]**

c) If $y = a\cos(m\log x) + b\sin(m\log x)$, show that
$x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+m^2)y_n = 0$. **[4]**

Q5) Solve any two :

a) If $u = \log(x^3 + y^3 - x^2y - xy^2)$, prove that $\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y}\right)^2 u = \frac{-4}{(x+y)^2}$. **[6]**

b) If $x = e^u \tan v$, $y = e^u \sec v$, find the value of $\left[x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}\right] \cdot \left[x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y}\right]$. **[7]**

c) If $v = f(e^{x-y}, e^{y-z}, e^{z-x})$ then show that $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial v}{\partial z} = 0$. **[6]**

OR

Q6) Solve any two :

a) Find $\frac{du}{dx}$ if $u = x.\log(xy)$ and $x^3 + y^3 + 3xy = 0$. **[6]**

b) If $u = \sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$ prove that

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\frac{\sin u \cos 2u}{4\cos^3 u}$$ **[7]**

c) If $x^2 = au + bv$, $y^2 = au - bv$ prove that $(u_x)_y.(x_u)_v = (v_y)_x.(y_v)_u$ where a, b are constants. **[6]**

Q7) a) If $ux = yz$, $vy = zx$, $wz = xy$ find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **[4]**

b) Examine for functional dependence $u=y+z$, $v=x+2z^2$, $w=x-4yz-zy^2$. **[4]**

c) Find the extreme values of $f(x, y) = 3x^2 - y^2 + x^3$. **[5]**

OR

Q8) a) If $u = x + y^2$, $v = y + z^2$, $w = z + x^2$ find $\left(\frac{\partial x}{\partial u}\right)_{v,w}$ by using Jacobians. **[4]**

b) The area of a triangle ABC, is calculated from the formula $\Delta = \frac{1}{2}\,bc\,\sin A$. Errors of 1%, 2% & 3% respectively are made in measuring b, c, A. If the correct values of A is 45°. Find the % error in the calculated values of Δ. **[4]**

c) Find stationary values of $a^3x^2 + b^3y^2 + c^3z^2$, where $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$. **[5]**

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Total No. of Questions : 8]

SEAT No. :

P4359

[Total No. of Pages : 2

[5458]-109

F.E. (All Branches) (Semester - I)

BASIC CIVIL AND ENVIRONMENTAL ENGINEERING

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat sketches must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***
5) ***Use of electronic pocket calculator is allowed in the examination.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) Differentiate between Plane and Geodetic Surveying with respect to any four points. **[4]**

b) What is settlement? Enlist its types and explain any one with a sketch. **[4]**

c) Explain importance of Quantity surveying with minimum four points. **[4]**

OR

Q2) a) State any two applications of each branch: Irrigation Engineering; Surveying. **[4]**

b) Briefly explain four tests for ascertaining quality of cement on site. **[4]**

c) What is pile foundation? Explain any one pile foundation type with sketch? **[4]**

Q3) a) Explain the term EIA? Explain any one method of EIA with sketch if applicable. **[5]**

b) Following readings were taken on 4m levelling staff at 25m interval. The readings were: BS = 1.225, 1.015, 2.155, 3.200; FS = 2.395, 2.885, 1.965, 3.500. The work was started from a point whose R.L. was 255.000m. Enter the readings for H.I. method and determine R.L.s of all the stations. Also find the gradient of the line joining first and last staff stations. Apply usual arithmetic check. **[7]**

OR

P.T.O.

Q4) a) What is Bench Mark? What are its types? Explain any two types in detail. **[7]**

b) Explain the role of Civil Engineers towards achieving sustainable development. **[5]**

Q5) a) Explain the principles of building planning with sketch: "Roominess"and "Privacy". **[8]**

b) What is Air plane rule? Explain with sketch. **[5]**

OR

Q6) a) A owner wants to construct three storeyed building on a plot size 30 m × 30 m. The Built up area on Ground floor is 400 Sq. m. and First Floor is 350 Sq.m. How much area can be constructed on second floor if the permissible FSI is 1.2. **[7]**

b) Explain in brief the following: **[6]**

i) Floor Space Index (FSI)

ii) Set back distances

iii) Carpet Area

Q7) a) What is Land Pollution? Give any three sources of Land Pollution. **[4]**

b) Explain with suitable examples conventional and non-conventional energy sources with respect to any four points. **[4]**

c) Write short note on sources and preventive measure for water pollution. Any two point. **[5]**

OR

Q8) a) Write a short note explaining working principle of Biogas plant with a neat sketch. **[7]**

b) Write a short note on "Need of Harnessing Energy Sources". [with 6 points] **[6]**

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Total No. of Questions : 8]

SEAT No. :

P4403

[Total No. of Pages : 3

[5458]-110

F.E.

ENGINEERING GRAPHICS - I

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn, wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) The point M of line MN is in HP while its other end N is 50 mm above HP and 80 mm in front of VP. The line is inclined to VP at an angle of 30°. Draw the projections of a line if its elevation makes 29° with HP. Find true length of line and the inclination made by the line with HP. Also, locate the traces of line. **[12]**

OR

Q2) Pentagonal plate of 25 mm side has one of its side in the VP & parallel to HP. The surface of plate makes an angle of 30º with VP. Draw its projections & find inclination of plate with HP. **[12]**

Q3) A square prism, side of base 40 mm and height 80 mm is kept on the HP on one of its corner of base edge in such a way that its axis makes an angle of 35º to the HP and VP. Draw the projection of the prism. **[13]**

OR

Q4) a) Draw a parabola by focus directrix method if focus is 60 mm from directrix. **[7]**

b) Draw the development of hexagonal prism with base side 25 mm and axis height 60 mm. **[6]**

P.T.O.

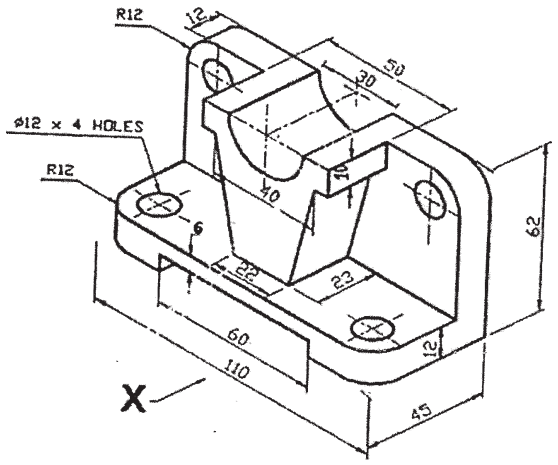
Q5) ***Figure*** shows isometric view of a shaft support. Draw following views:**[13]**

a) Front View looking in the direction of X.

b) Top View.

c) Sectional Right hand side view, section along line of symmetry.

d) Show all dimensions.



(All dimensions are in mm)

OR

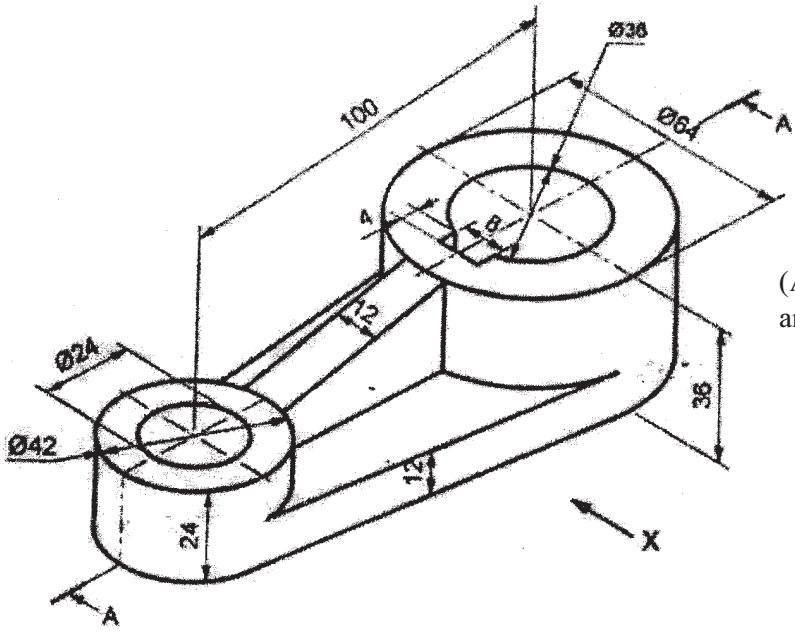
Q6) ***Figure*** shows isometric view of a Machine component. Draw following views: **[13]**

a) Sectional Front View looking in the direction of X (Section A-A)

b) Top View

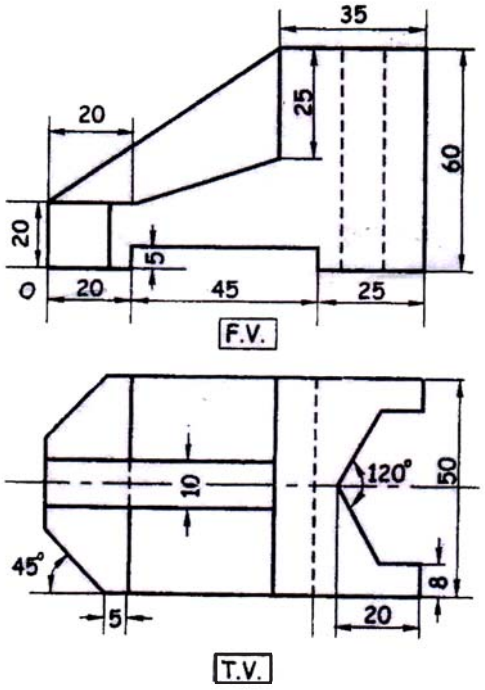
c) Left hand side view

d) Show all dimensions



(All dimensions are in mm.)

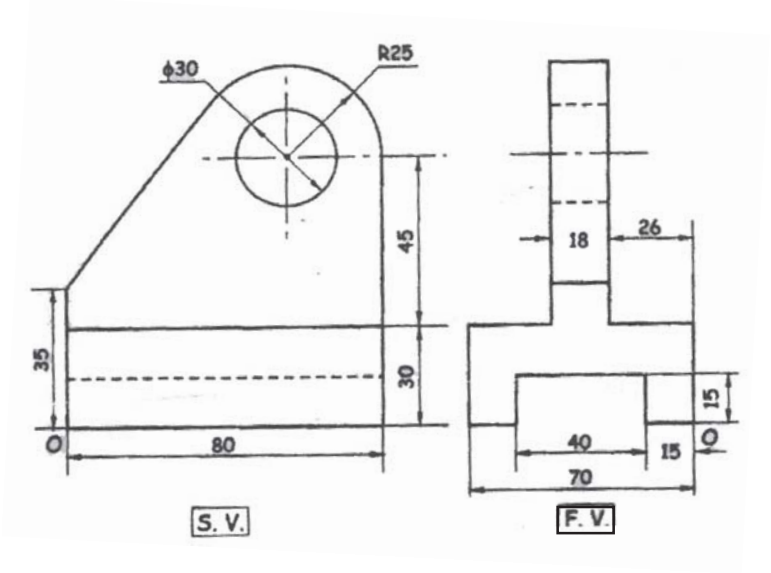
Q7) Figure shows front view & top view of object, Draw isometric view & show overall dimensions. **[12]**



(All dimensions are in mm.)

OR

Q8) Figure shows front view & right hand side view of object, Draw isometric view & show overall dimensions. **[12]**



(All dimensions are in mm.)

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