

II Year B.E/B.Tech
ELECTRICAL AND ELECTRONICS
ENGINEERING (EEE)



MODEL QUESTION PAPERS

(Effective from 2005 admitted batch)

SCHOOL OF DISTANCE EDUCATION
ANDHRA UNIVERSITY
VISAKHAPATNAM - 530 003

II Year B.E./B.Tech Degree Examinations
MATHEMATICS - III

(Common to Civil, Mechanical, EEE & ECE Branches)

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory
Answer any four from Questions 2 to 8
All questions carry equal marks

1. a) Define scalar and vector point functions.
b) Write down the physical interpretation of curl.
c) Explain briefly the wave equation with reference to transverse vibration of a string.
d) Define Fourier transforms of the derivatives of a function.
e) State Parseval's identity for F - transforms.
2. a) What is the directional derivative of $\phi = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the normal to the surface $x \log z - y^2 = -4$ at $(-1, 2, 1)$?

- b) Verify Stoke's theorem for the vector field

$\vec{F} = (2x - y)\vec{i} - yz^2\vec{j} - y^2z\vec{k}$ over the upper half surface of $x^2 + y^2 + z^2 = 1$ bounded by its projection on the xy plane.

3. a) If r and \vec{R} have their usual meaning and \vec{A} is a constant

vector prove that
$$\nabla_x \left\{ \frac{\vec{A} \cdot \vec{R}}{r^n} \right\} = \frac{2-n}{r^n} \vec{A} + \frac{n(\vec{A} \cdot \vec{R})}{r^{n+2}} \vec{R}.$$

- b) Prove that the spherical polar coordinate system is orthogonal.
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4. a) If $f(z)$ is a regular function of z prove that

$$\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right] |f(z)|^2 = 4|f'(z)|^2$$

b) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2 + 1)(x^2 + 4)}$

5. a) Find the Fourier transform of $e^{-x^2/2}$

b) Find the Fourier sine transform of $f(x) = \begin{cases} 1, & 0 \leq x \leq a \\ 0, & x \geq a \end{cases}$

6. a) Find a solution of the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y} + 2u$ in the form

$u = f(x)g(y)$. Solve the equation subject to the conditions

$u = 0$ and $\frac{\partial u}{\partial x} = 1 + e^3 y$ when $x = 0$ for all values of y .

- b) A tightly stretched flexible string has its ends fixed at $x = 0$ and $x = l$. At time $t = 0$ the string is given a shape given by $f(x) = \mu x(l - x)$ where μ is a constant and then release. Find the displacement of any point x of the string at any time $t > 0$.
7. a) A continuous distribution of a variable x in the range $(-3, 3)$ is defined as

$$f(x) = \frac{1}{16}(3+x)^2, \quad -3 \leq x \leq 3.$$

$$= \frac{1}{16}(2+6x)^2, -1 \leq x \leq 1.$$

$$= \frac{1}{16}(3+x)^2, -1 \leq x \leq -3.$$

Verify that the area under the curve is unity. Show that the mean is zero.

b) Fit a Poisson distribution to the following.

x	:	0	1	2	3	4
f	:	46	38	22	9	1

8. a) Find the correlation coefficient from the following data :

x	:	1	2	3	4	5
y	:	2	5	3	8	7

b) The following results were obtained in Applied Mechanics and Engineering Mathematics in an examination. Given $r = 0.95$, Find both the regression equations.

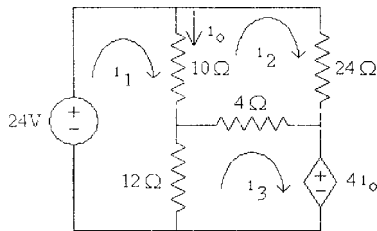
	Applied Mech.	Engg. Maths
	(x)	(y)
Mean	47.5	10.5
Standard deviation	16.8	10.8

II Year B.E./B.Tech Degree Examination

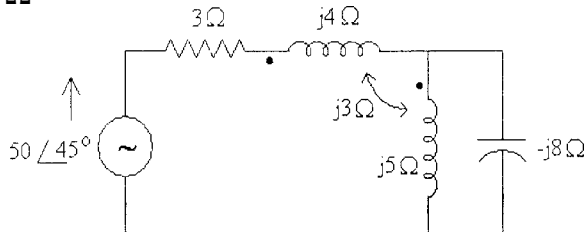
NETWORK THEORY

(Common to EEE & ECE Branches)

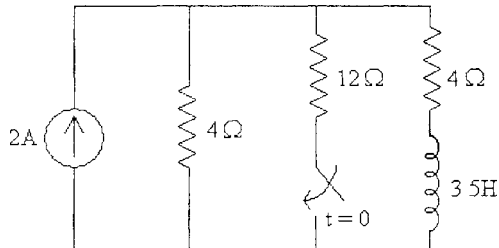
1. a) State and explain duality theorem. (5 x 3 = 15)
- b) What is source free response? Explain in detail different cases of natural response of an RLC circuit.
- c) State and explain Superposition theorem.
- d) Give the restrictions on pole and zero locations for driving point functions.
- e) Using R-H criterion, check the stability of the network having the denominator polynomial of the network function given as $Q(s) = 2s^4 + s^3 + 3s^2 + 5s + 10$
- 2) a) Use mesh analysis to obtain i_o in the circuit given below.



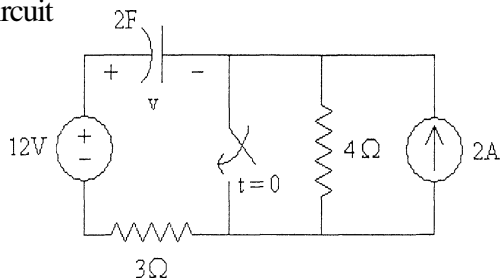
- b) For the circuit shown in the figure, find the voltage across $j5\Omega$



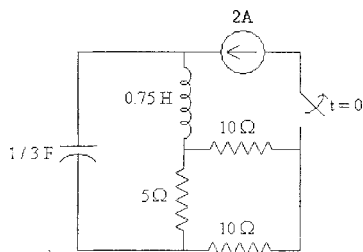
- 3) a) Explain in detail different cases of natural response of an RLC circuit.
- b) Obtain the inductor current for both $t < 0$ and $t > 0$ in the circuit given below.



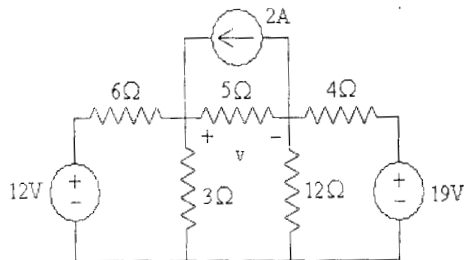
- 4) a) Find the capacitor voltage 'v' for $t < 0$ and $t > 0$ for the given circuit



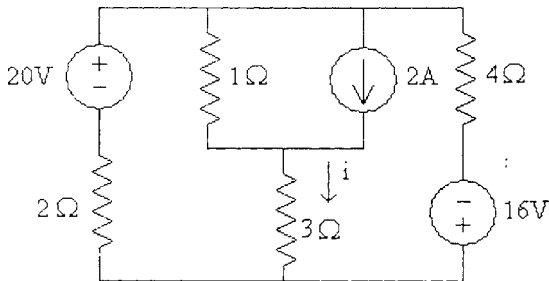
- b) Calculate $i(t)$ for $t > 0$ in the circuit given below using Laplace transform method.



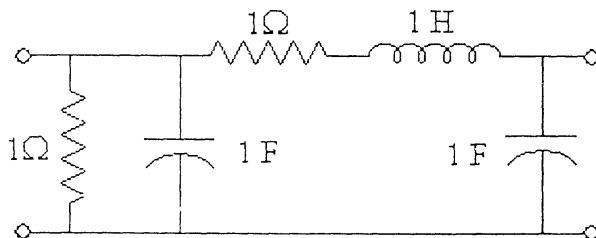
- 5) a) State and prove initial and final value theorems.
 b) Use Thevenin's theorem to find 'v' in the circuit.



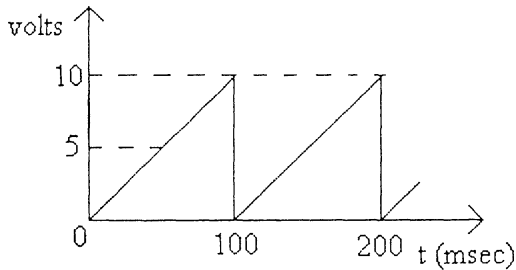
- 6) a) Use Norton's theorem to find current 'i' in the circuit.



- b) Determine the 'z' parameters of two-port network given in the figure.



- 7) a) A periodic voltage waveform has been shown. Determine rms value, average value, form factor.



b) A four wire Y–Y circuit has

$$V_{an} = 120 \angle 120^\circ V, V_{bn} = 120 \angle 0^\circ V \text{ and}$$

$$V_{cn} = 120 \angle -120^\circ V . \text{ If the impedances are}$$

$$Z_{AN} = 20 \angle 60^\circ \Omega, Z_{BN} = 30 \angle 0^\circ \Omega \text{ and } Z_{CN} = 40 \angle 30^\circ \Omega$$

find the current in the neutral line.

- 8) a) Design a series RLC circuit, which will have an impedance of 10Ω at the resonant frequency of $\omega_0 = 50 \text{ rad / sec}$ and a quality factor of 80. Find also the bandwidth.
- b) Determine the line current in a 3 – ϕ system with a line voltage of 300V that supplies 1200 Watts to Delta connected balanced load at a lagging power factor of 0.8. Find also the impedance of each phase.

II Year B.E./B.Tech Degree Examination

ELECTRONICS-II

(Common to EEE & ECE Branches)

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory

Answer any four from Questions 2 to 8

All questions carry equal marks

1. a) What do you understand by feedback in amplifiers? Explain the terms feedback factor and open loop gain.
b) What are the characteristics of an ideal operational amplifier?
c) In class A power amplifier circuit, $V_{cc} = 20\text{V}$, the load resistance is 12Ω . Find out power, input power and efficiency.
d) Explain lower and upper triggering voltages in a Schmitt trigger.
e) Give the simple Miller Sweep circuit using NPN transistor and explain.
2. a) Draw the circuit of Wien Bridge oscillator and explain the principle of operation.
b) Derive the expression for its frequency of oscillations. What is the condition on β for getting sustained oscillations.
c) State Barkhausen Criterion for oscillation.
3. a) Obtain the response of an RC high-pass filter to a step input.
b) Obtain the condition of RC high-pass filter to behave as a good differentiator.
c) Obtain the response of an RC high-pass filter and to a pulse input for $Rc/tp \gg 1$ and $Rc/tp \ll 1$.

4. a) Draw the circuit of class B Power amplifier using BJT and explain its working principle. Derive the expression for its efficiency.
- b) What are the advantages of push pull amplifiers
5. a) Draw the circuit diagram of a single tuned FET Amplifier and explain its operation.
- b) What are the advantages of doubled tuned amplifiers over single tuned amplifiers.
6. a) Draw the circuit diagram of an emittercoupled binary and explain its operation. State its advantages over collector-coupled binary circuit.
- b) Design an astable Multivator to produce the squate wave at 10KHZ. With 30% duty cycle. Use transistors having $(h_{fe})_{\min}=60$, $V_{BE}(\text{sat})=0.7\text{V}$. $V_{BE}(\text{cut off})=0\text{V}$ and $V_{CE}(\text{sat})=0.2\text{V}$. Assume $I_c(\text{sat})=1\text{mA}$ and $V_{CC}=10\text{V}$. Show the circuit diagram with all-----
7. a) Draw the circuit diagram of a linear current time base generator and explain its operation with waveforms.
- b) Explain the following with relevant sketches
 - i) Diode clipper at two independent levels
 - ii) Diode Clamping circuits
8. a) Explain the concepts of Miller and Bootstrap time base generators with neat circuits.
- b) Write short notes on the following
 - i) Simple current sweep generator
 - ii) Transistor as a switch
 - iii) Comprator Circuit.

II Year B.E./B.Tech Degree Examination
PERFORMANCE AND DESIGN OF ELECTRICAL MACHINES-I
Electrical & Electronics Engineering

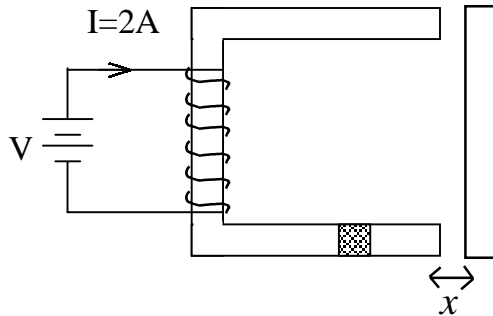
Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory
Answer any four from Questions 2 to 8
All questions carry equal marks

1. a) What is the significance of co-energy in the derivation of expression for force/torque of an electromechanical energy conversion device? (3M)
- b) What is back e.m.f? Is this back e.m.f. greater or lesser than applied voltage? Why? By what amount do the two voltages differ? (3M)
- c) Explain why a starter is required for starting a dc motor? (3M)
- d) Define the terms 'continuous rating', 'continuous maximum rating' and short time rating? (3M)
2. a) For a singly excited magnetic system, establish relationship between magnetic field energy and co-energy? Develop also the relation for the magnetic stored energy in terms of reluctance?
- b) For the electro-magnetic system shown in fig. below, each limb of the core has cross-sectional area of 25 cm². The coil has 1,000 turns. Assume that the iron part of the magnetic circuit has $\mu_r = \infty$.

For a coil current of 2 A and air-gap length $x = 1\text{ cm}$; calculate (i) the co-energy of the magnetic field, and (ii) the force on the movable component.



3. a) How demagnetizing and cross-magnetizing ampere turns per pole are calculated in a D.C. machine? Explain reactance voltage in case of a D.C. machine
- b) A 4-pole generator supplies a current of 140A. It has 492 armature conductors (a) wave connected, (b) lap connected. When delivering full load, the brushes are given an actual lead of 10° . Calculate the demagnetizing armature ampere turns per pole. The field winding is separately excited and takes 10A; find the number of extra field turns necessary to neutralize this demagnetization. Also calculate the cross magnetizing armature ampere-turns per pole.
4. a) Classify various losses in the dc machine and indicate the factors on which these depend. Explain the regenerative method of determine the efficiency of the dc machine. List the merits and demerits of the method?
- b) The Hopkinson test on two d.c. shunt machines gave the following results for full load; line voltage 250V; Line current 45A excluding field currents; motor armature current 385A; field currents 5A and 4A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.015Ω .

5. a) What are the different losses occurring in a transformer on load? How can these losses be determined experimentally?
- b) A 200k VA, 11000/400V, delta-star distribution transformer gave the following test results.

Open – circuit test : 400V, 9A, 1.50kW.

Short – circuit test : 350V, rated current, 2.1kW.

Calculate the equivalent circuit parameters referred to the h.v.side and its efficiency at half full load of unity power factor.

6. a) Discuss different classes of motor duty cycles? Give industrial application for each class of duty cycle? Explain the method for determining the rating of an electric motor which is subjected to short time duty?
- b) A 400 kVA transformer has its maximum efficiency at 80 percent of full load. During a short full load heat run the temperature, the temperature rise after one hour and two hours is observed to be $24^{\circ}C$ and $34^{\circ}C$, respectively. Find the thermal time constant and final steady temperature rise of the transformer.
7. a) Discuss and derive the expression for main dimensions of
 i. Single - phase transformer
 ii. three-phase transformer
- b) A 100 kVA, 6600/440 V, 50Hz, 3 phase, delta/star, core type, oil immersed natural cooled (ON) transformer. The design data of the transformer is:
 Distance between centers of adjacent limbs = 0.47m, outer diameter of high voltage winding = 0.44m, height of frame = 1.24m.
 Core loss=3.7KW and $I^2 R$ loss=10.5 kW,
 Design a suitable tank for the transformer. The average

temperature rise of oil should not exceed $35^{\circ}C$.

The specific heat dissipation from the tank walls is $6W/m^2-0C$ and $6.5 W/m^2-0C$ due to radiation and convection respectively. Assume that the convection is improved by 35% due to convection.

- 8.** Write short-notes on the following
- a) Constructional features of rotating machines?
 - b) Vee and Tee connections of transformer?
 - c) Cross-field machines?
 - d) Guiding factors for design of armature winding?

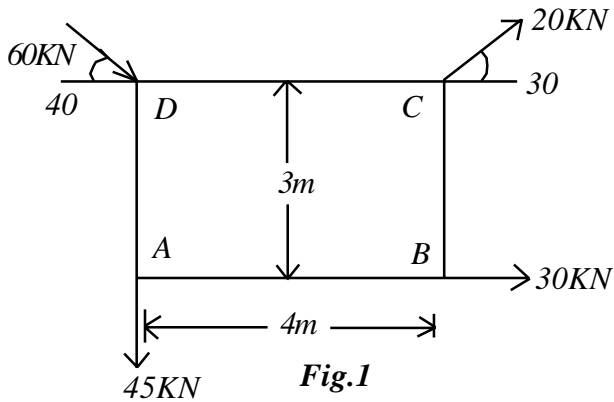
II Year B.E./B.Tech Degree Examination
ENGINEERING MECHANICS & STRENGTH OF MATERIALS
Common to EEE & ECE Branches

Time : Three hours

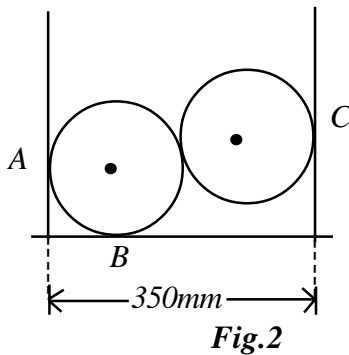
Maximum : 75 Marks

Question 1 is compulsory
Answer any four from Questions 2 to 8
All questions carry equal marks
Assume any missing data if necessary

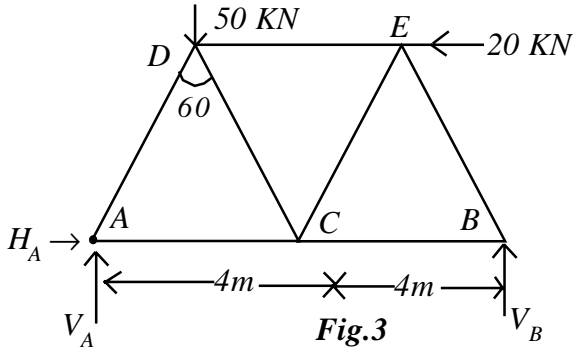
- Q.1
- a) Determine the moment of Inertia of a square with a side of 300mm about its diagonal.
 - b) The motion of a particle is described by $x = 10 \cos 3t$. Find the amplitude, time period and velocity at $t = 2$ sec.
 - c) The curvilinear motion is given by its normal acceleration equal to 3 m/sec^2 ; tangential acceleration being zero. If the radius of curvature is 60cm. Find linear velocity and angular velocity.
 - d) At a point in a body the stresses are given by
 $\sigma_x = 10$; $\sigma_y = 6$ and $\tau_{xy} = 3 \text{ N/mm}^2$. Find the principal stresses and the maximum shear stress.
 - e) A cantilever having a span of 6m is subjected to a concentrated load of 20kN. Draw SFD and BMD indicating their maximum values.
2. a) Determine the magnitude and direction of the resultant of four forces acting on a rectangle where the resultant cuts the line AB. see Fig.1.



- b) Two smooth spheres each of weight 1200 N and of radius 250mm rest in a channel as shown in Fig 2. Find the reactions at A,B,C, if $\mu = 0.2$.



3. a) Determine the forces in all the members of a warren truss loaded as shown in Fig 3.



4. a) Derive the equation for time period in simple harmonic motion.
- b) A body of mass 40kg. moving with a velocity of 6m/s collides directly with a body of mass 25kg. Find their common velocity if they move together after impact.
5. a) Define angular momentum and what is its relation with the torque causing rotation.
- b) A motor cyclist wants to jump over a ditch from A to B. Find the minimum velocity at A and the velocity when he reaches B. See Fig.4.

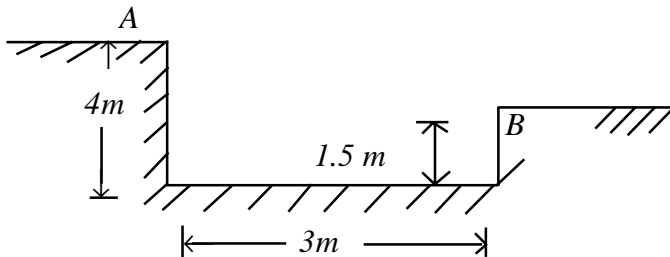


Fig.4

6. a) Derive the equations for principal stresses when σ_x , σ_y and τ_{xy} are acting at a point.

- b) In a stressed body the maximum normal stress is 15 N/mm^2 .
A plane inclined at 45° to the principal plane carries a shear stress of 3 N/mm^2 . Find the normal stress on a plane making an angle of 30° with the principal plane.
7. a) Derive an equation for calculating the bending stress in pure bending.
- b) A simply supported beam of span 9 m is subjected to a U.D.L of 25 kN/m . Find the normal stress at the bottom of mid span if $b=300 \text{ mm}$ and $D=700 \text{ mm}$.
8. a) A twisting moment of 40 kNm . acts on a shaft of diam 300 mm . Find the maximum shear stress and angle of twist per unit length if $G=0.8 \times 10^5 \text{ N/mm}^2$
- b) Determine the deflection at the free end of a cantilever having a span of 6 m and subjected to a U.D.L of 15 K.N.M throughout along with a concentrated load of 40 KN . at the free end. Assume EI is constant and calculate deflection in terms of EI .

II Year B.E./B.Tech Degree Examination
THERMAL PRIME MOVERS
Electrical & Electronics Engineering

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory
Answer any four from Questions 2 to 8
All questions carry equal marks

1. a. State Boyles law and Charles law and prove characteristic equation is $PV = mRT$
 - b. What are mountings and accessories in a boiler and differentiate between the two.
 - c. Discuss in brief classification of compound steam engines.
 - d. Briefly discuss the air fuel ratio requirements of a petrol engine from no load to full load.
 - e. Distinguish between impulse turbine and reaction turbine.
2. a) What is dryness fraction? Explain with a neat sketch the working of a separating calorimeter.
 - b) Dry saturated steam at a pressure of 1.1 bar expands polytropically according to $PV^{1.3} = \text{constant}$, to a pressure of 1 bar. Determine (i) the final condition of steam and (ii) the amount of heat transferred per kg of steam and (iii) the change of entropy.
3. a) What are the differentiating features between water tube and fire tube boiler
 - b) A boiler is provided with a chimney of 25 m height. The boiler house temperature is $30^{\circ}C$ and the temperature of the gas leaving the chimney is $300^{\circ}C$. If the air supplied to

the boiler is 19kg per kg of fuel, calculate (i) draught in mm of water column (ii) velocity of gas passing through the chimney with 50% loss of draught due to friction.

4. a) Describe with a neat sketch the working of a Wolf type compounding steam engine
- b) A single cylinder double acting steam engine has a piston diameter 250mm, stroke 400mm and diameter of the piston rod 50 mm. the mean effective pressure on both sides of the piston is 2.5 bar. Determine the indicated power when the engine runs at 200 rpm.
5. a) Explain with a neat sketch the working of a four stroke S.I.engine
- b) An air standard dual cycle has a compression ratio of 10 the pressure and temperature at the beginning of compression are 1 bar and $27^{\circ}C$ the maximum pressure reached is 42 bar and the maximum temperature is $1500^{\circ}C$ determine (i) temperature at the end of constant volume heat addition (ii) cut-off ratio (iii) work done per kg of air (iv) cycle efficiency. Assume $c_p = 1.004 kJ / kg K$ and $c_v = 0.717 kJ / kg K$ for air.
6. a) With a neat sketch, explain the working of a simple carburetor.
- b) Explain the reasons for cooling an engine, explain any two types of cooling systems.
7. a) Briefly explain with a neat sketch throttle governing of steam engines.
- b) Steam enters a group of convergent - divergent nozzles at a pressure of 22 bar and with a temperature of $240^{\circ}C$, the

exit pressure is 4 bar and 9% of the total heat drop is lost in friction. The mass flow rate is 10 kg/s and the flow up to throat may be assumed frictionless. Calculate (i) throat and exit velocities (ii) throat and exit areas.

8. a) Draw a neat sketch of locomotive boiler, label the parts and explain its working.
- b) What are mountings accessories in a boiler. Explain any two mountings and accessories in a boiler.

II Year B.E./B.Tech Degree Examinations
FLUID MECHANICS & HYDRAULIC MACHINES

Electrical & Electronics Engineering

Time : Three hours

Maximum : 75 Marks

Question 1 is compulsory
Answer any four from Questions 2 to 8
All questions carry equal marks

1. Answer the following briefly. Each bit carries 3 marks.
- a) A glass tube is of internal diameter 6mm is dipped in a trough containing water. If the surface tension of water is 0.073N/m and angle of contact is 0° , what will be the capillary rise in the tube?
 - b) Calculate the unknown velocity component in the following, 2-D flow, so that the equation of continuity is satisfied?
 $u = A \ln(x/L) : v = ?$
 - c) What is the relation between the total energy, velocity head, pressure head and datum.
 - d) A compound piping system consists of 1800 m of 50 cm, 1200m of 40cm and 600 m of 30cm pipes of the same material connected in series. What is the equivalent size of the pipe of 3600 m long?
 - e) Distinguish between Impulse and reaction turbines.
2. a) Define kinematic viscosity. What are its dimensions and units in SI system? (4 Marks)
- b) A circular disc of radius ' R ' rotates at an angular velocity ' ω ', maintaining a small distance ' h ' above a fixed bed under the support of a fluid layer of viscosity is ' μ '. Obtain the

- expression for the torque on the disc. (7 Marks)
- c) Define centre of pressure. (4 Marks)
- 3 a) Define local, convective and total accelerations (4 Marks)
- b) Derive continuity equation in three dimensional Cartesian coordinates. (6 Marks)
- c) Draw the sketch of a prandtl type of Pitot tube along with the pressure measuring device. (5 Marks)
4. a) Derive Bernoulli equation through integration of Eulers equation for irrotational flow. What are the assumptions? (7 Marks)
- b) An oil of sp.gr.0.90 flows through a vertical pipe of diameter 20 cm. The flow is measured by a 20cm x 10cm venturimeter. The throat is 10cm above the inlet. A differential U-tube mercury manometer is connected to the Venturimeter. If $C_d = 0.09$, what is (a) the flow for a manometer reading of 9 cm and (b) the manometer reading for a flow of 50 lps? (8 Marks)
5. a) Distinguish between the energy principle and momentum principle with reference to their application to practical problems. (5 Marks)
- b) A reducer bend having an outlet diameter of 15 cm discharges freely. The bend connected to a pipe of 20 cm diameter, has a deflection of 60° and lies in a horizontal plane. Determine the magnitude and direction of force on the anchor block supporting the pipe when a discharge of $0.3 \text{ m}^3 / \text{s}$ is passing through the pipe. (6 Marks)
- c) Show that the coefficient of discharge for an orifice is equal to the product of the coefficient of velocity and coefficient of contraction. (4 Marks)

6. a) Derive the condition for maximum transmission of power through a nozzle fitted at the end of a pipe (5 Marks)
- b) Water is discharged from a reservoir into the atmosphere through a pipe 39m long. There is a sharp entrance to the pipe and the diameter is 50 mm for 15 m from the entrance. The pipe then enlarges suddenly to 75 mm in diameter for the remainder of its length. Taking into account the loss of head at entry, enlargement, calculate the difference of level between the water surface of the reservoir and the pipe exit which will maintain a flow of 2.8 lts/sec. Take $f = 0.02$ for 50 mm pipe and 0.025 for 75 mm pipe. Draw also HGL and total energy gradient lines. (6 Marks)
- c) Explain the function of Surge tanks. List the various types of Surge tanks. (4 Marks)
7. a) Obtain the expression for the work done by water that strikes a series of curved vanes mounted on a wheel. (6 Marks)
- b) In a single acting reciprocating pump, the cylinder has a diameter of 150 mm and a stroke of 300mm. The water is to be raised to a height of 20m when the pump is running at 40 rpm. Determine the theoretical discharge and theoretical H.P. If the actual discharge of the pump is 3.5 Ips, find coefficient of discharge and % slip. (5 Marks)
- c) Obtain an expression for the minimum starting speed of a centrifugal pump. (4 Marks)
8. a) Draw a neat sketch of Pelton turbine showing its main component parts and then explain their function in detail (7 Marks)
- b) A Francis turbine is fitted with a vertical conical shaped draft tube. The top and bottom diameters of draft tube are 60 cm and 90 cm respectively. The tube is running full with water

and it has a vertical height of 6 m out of which 1.5 m is drowned in the tail race water. Assume that the friction loss of head between top and bottom points as 0.3 times kinetic head at the draft tube exit. The velocity of exit is 1.5 m/s. Determine (i) the pressure head at the top point of draft tube, (ii) the total head at the same point with reference to the tail race as datum, (iii) the total head of the bottom point with tail race as datum, (iv) the power in the water at the top and bottom of the tube and (v) efficiency of the draft tube.

(8 Marks)

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